ENGINEERING AND MINING JOURNAL

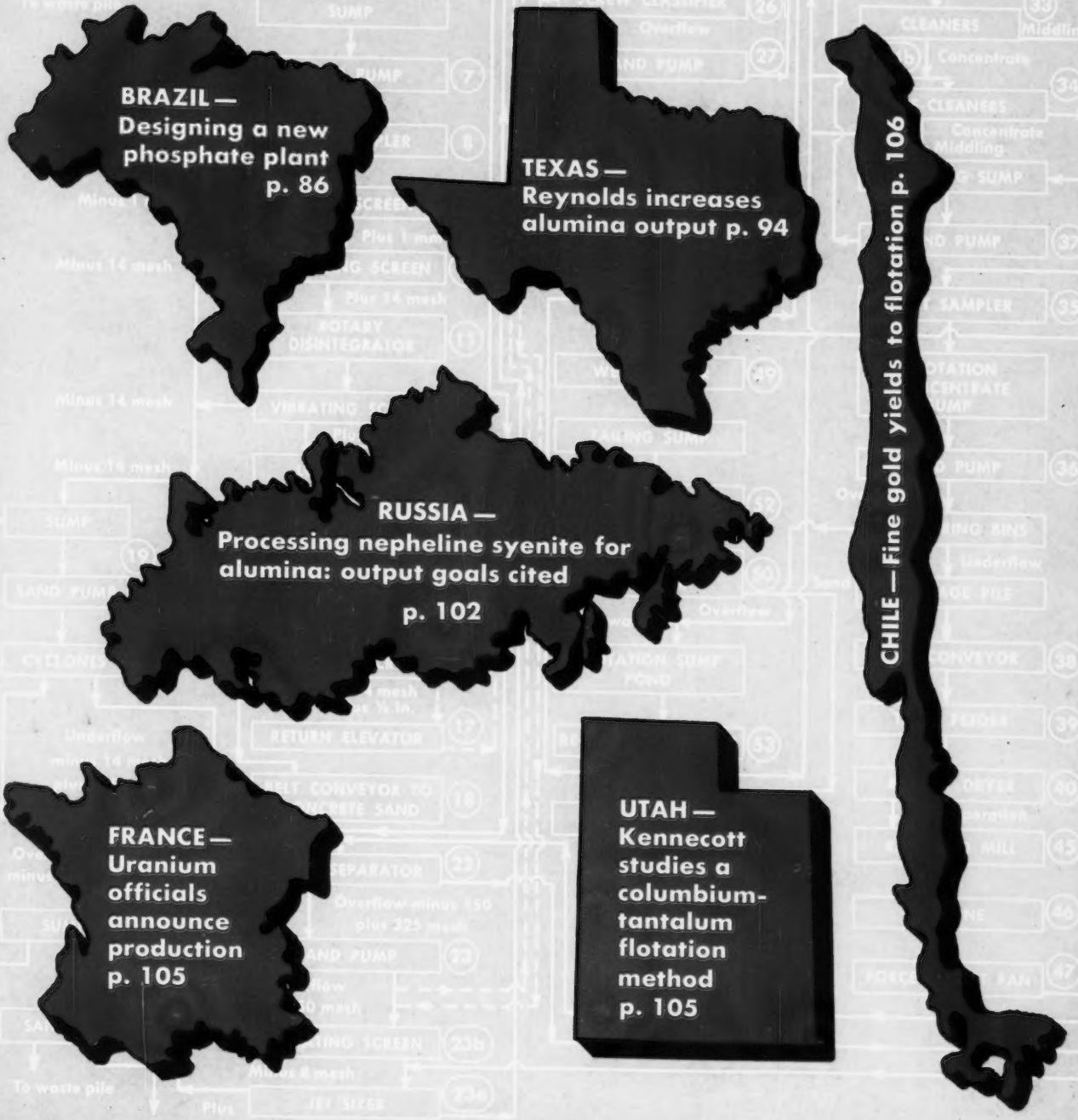
A McGRAW-HILL PUBLICATION

MAY 1959

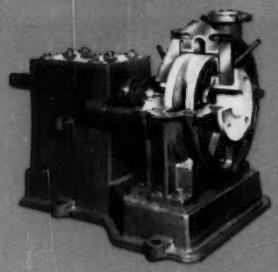
PRICE ONE DOLLAR

FOUNDED 1866

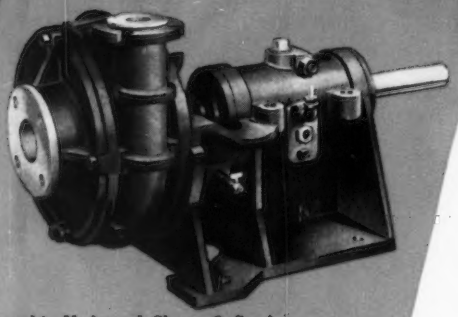
World Progress in Mineral Processing



1/4 CENTURY steady advance in pumping abrasives corrosives



It all began with this Slurry & Sand pump, the first to attain life-long high efficiency through patented Hydrosealing protection of critical clearances, and the first to offer the economy of removable rubber wearing parts.



Later came this Hydroseal Slurry & Sand pump, redesigned chiefly in the mechanical end, notably a change from babbitted to anti-friction bearings, with the patented axial adjustment feature. It is famous in mining fields throughout the world for its efficiency and economy. Now . . .

The basis of our progress in pump design is our practice of keeping performance records of practically every A-S-H pump sold. The resulting vast fund of data not only enables our engineers to solve tough problems with existing pumps, but helps them spark ideas for improving elements in their design.

To what advance may your pumping problem lead?

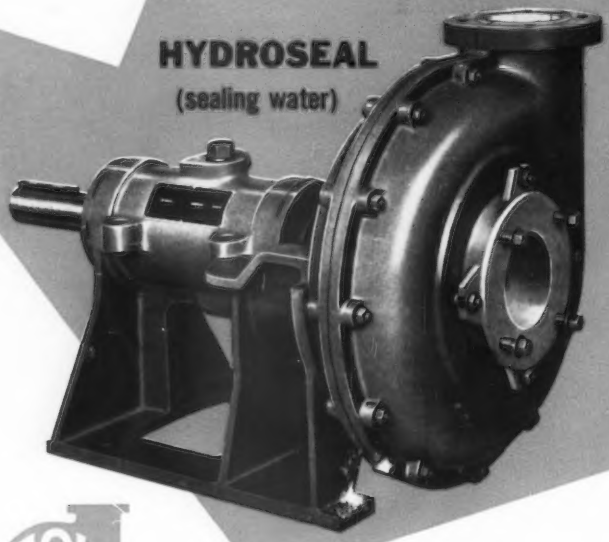
Write us.

SPLIT-SHELL Design

Interchangeable • Rubber-lined • Slurry & Sand

HYDROSEAL
(sealing water)

CENTRISEAL
(no sealing water)
delivers pulp UNDILUTED

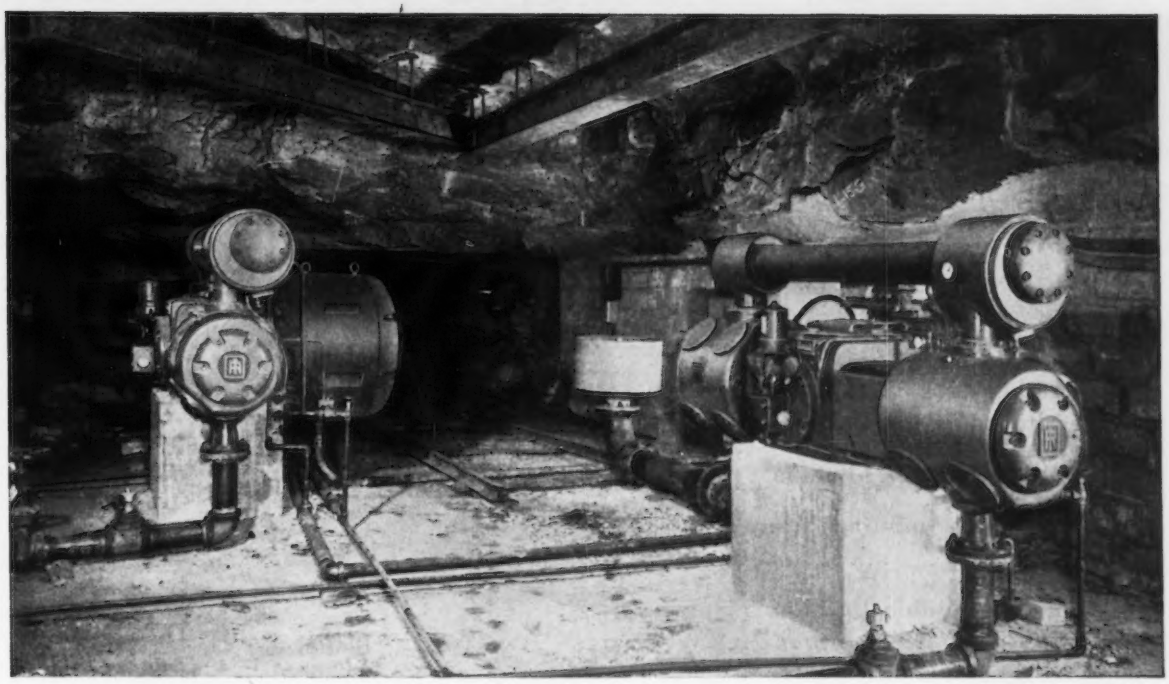


THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

HYDROSEAL and CENTRISEAL
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

CRAMPED FOR SPACE?

PHE compressors need less headroom, can be skidded in fully assembled

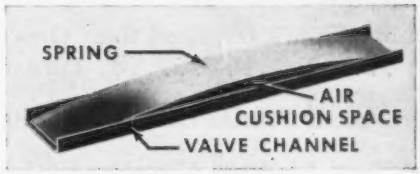


Squeezing a heavy-duty compressor through narrow drifts and installing it in a tight place is an old mining problem. The solution may be an Ingersoll-Rand PHE compressor... as was the case in the mine picture above.

These packaged units are ideal for mine service – they can be skidded through tight places completely assembled and installed on a simple block foundation.

The PHE is a two-stage intercooled compressor with balanced-opposed cylinder construction in 75 and 100-hp sizes, built for continuous full-load operation. Bearing wear and overall maintenance costs are minimized, due to (1) long-life aluminum full-floating bearings, (2) filtered force-feed lubrication, and (3) a completely sealed crankcase that never needs to be opened for any adjustments.

PHE compressors feature the Channel Valve, renowned for its remarkable durability, long life, and freedom from maintenance. Each valve is a



combination of straight-lifting, stainless-steel valve channels and leaf springs, which form trapped air spaces to cushion the opening action. This exclusive air-cushioned design prevents impact, reduces wear, and assures quiet, efficient operation. And remember, *only I-R compressors have Channel Valves!*

For further information on compressors, rock drills, and other equipment for mining services, contact your Ingersoll-Rand representative.

Ingersoll-Rand

1-746

11 Broadway, New York 4, N.Y.

PUMPS • COMPRESSORS • CONDENSERS • VACUUM EQUIPMENT • GAS & DIESEL ENGINES • ROCK DRILLS • AIR & ELECTRIC TOOLS

MAXIMIX RUBBER PROTECTED

ENGINEERING AND MINING JOURNAL

93rd YEAR OF PUBLICATION

MAY 1959

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B.F.Goodrich

V belt briefs

TIPS ON THE CARE, MAINTENANCE AND SELECTION OF V BELTS FOR INDUSTRY

The right way to install and run-in V belts

To get the most possible life out of a set of V belts you've got to install them and run them in properly:

To install V belts:

1. Move driver unit toward driven machine so that belts may be placed in sheave grooves by hand.
2. Work belt slack to top side of drive.
3. Move driver unit back into position, eliminating all belt sag.
4. Check sheave alignment.

To run-in V belts:

1. Start unit and operate long enough to permit belts to properly seat in grooves.
2. Stop unit. Adjust centers as necessary until all belts have proper tension.
3. Review adjustment from 24 hours to 48 hours after drive is in operation. This is important, for new belts stretch slightly and seat in grooves before reaching their working lengths.

It pays to keep belts stored properly

V belts should be stored in a cool, clean, dry place. Avoid heat and direct sunlight. Do not hang on nails or other small objects which might cause a sharp bend or tension that would result in a permanent set in V belt. Oldest belts should be used first to keep fresh stock. Matched belts should be banded together so they don't become separated.

BELTS BOIL IN HOT MILL SAND—*The V belts driving this ball mill help grind hot sand, heated to 260°, to a fluffy powder used for fine glass, pottery, cosmetics. Ordinary V belts were lasting one to two years. B.F.Goodrich Grommet belts replaced them, have lasted over five years. Grommet belts stay cooler because they generate less internal heat and are made of a rubber that takes higher temperatures.*

What caused this V belt failure?

Answer: Prematurely worn sides are caused by grit, dirt or any such abrasive contact. Misalignment often causes wear on one side only. To prevent, align the sheaves, checking with straight-edge or cord. Keep belts and sheave grooves clean.

B.F.Goodrich V belt manual

Your B.F.Goodrich distributor has a new maintenance manual that tells you how to get longer life from your V-belt drives. Its 12 illustrated pages contain information on how V belts work, how to select V belts that fit, how to install, how to keep them running, and how to spot trouble.

Take a look inside with this X-ray of a Grommet belt

This model of a B.F.Goodrich Grommet belt was made of a transparent, flexible material so that you can see its grommet construction. The two endless loops you see are grommets, the load-carrying members of the B.F.Goodrich belt. These are made by winding heavy cord on itself to make an endless cord grommet.

In the actual belt, these grommets float in a bed of solid rubber. You can *see* why every part of the belt is equally flexible—there are no stiff plies to resist bending. Most cord failures occur where cords overlap. But in the B.F.Goodrich Grommet belt with endless cord construction this cause of failure is eliminated.

Ask a factory-trained specialist

For help in selecting V belts for any kind of service, call the man who is a specialist in V belts—your B.F.Goodrich distributor. He can help you cut costs by getting longer life from your V belt drives. *B.F.Goodrich Industrial Products Company, Dept. M-596, Akron 18, Ohio.*

B.F.Goodrich V belts

Behind the By-Lines...

If, after looking at this month's cover, you are about to take pen in hand to inform us that Texas is not as big as Russia, or that the scale of all those sovereign states is more than a little off—please don't.

Our Art Director is completely neutral on the subject of Texas, and he knows it ain't that big, it's just that the cover looked better with a little exaggeration here and there.

Then, too, if your eldest is in search of a map to illustrate one of his school reports, you might warn him that we've done more than alter the scale. For design purposes, we wanted to print some words in each silhouette. Everything was just fine 'til we got to Chile. Now, Chile is a great nation, and we're looking forward to our next trip there, but let's face it, our copper-gold-iron ore and-etc. mining friends live in a country that is a lot longer than it is wide.

What we're trying to say is that we took some license with borders, and fattened the country up so we could print a headline. Please forgive us, everyone, it's the pressure of the times.

There now, we've confessed.

You can take the rest of the issue pretty much as gospel, with some interesting chapters and verses.

For instance, the figures on Soviet aluminum production represent the beginning of a trend in reporting Russian technology. For years, the best information from the USSR on production spoke of percent increases and relative expansions. Lately, though, the actual figures are appearing more frequently and more specifically. The story on p 102 is a combination of the work of McGraw-Hill's correspondent in Bonn and the kind permission of the French magazine *Revue d'Aluminium,* which first printed the maps. It's darned interesting reading.

We're as enthusiastic as the Copper & Brass Research Association about their 1959 competition for an outstanding achievement in "the use, application, or metallurgy of copper and its alloys." The award competition, which accepted final entries April 30, will be judged and the winner's named at CABRA's annual meeting May 13.

When an industry offers a $1,000 award for better research it comes under the heading of real bootstrap pulling. The winner will also receive a bronze plaque.

That figures.

If you are a member of the growing army of individuals who are being called upon almost daily to submit reports, articles, manuals and instruction sheets, help is on the way. No longer must you sit staring at the blank sheet of paper while cold perspiration breaks out.

Tyler G. Hicks, one of the most informed editors and writers of our acquaintance, has written a book entitled "Successful Technical Writing," expressly for the man in today's industry who must do more reportorial writing than he ever dreamed of back in school.

The book, published by McGraw-Hill Book Co., 330 West 42nd St., New York 36, N.Y., provides a step-by-step treatment of the problems and solutions of report writing for intercompany communication as well as the writing of technical articles for publication.

The first rule, according to Ty, is to have a story to tell. Second is to find out if an editor wants it, and what form he'd like to see; what illustrations he thinks would help tell the story. Third, give it to a publication as an exclusive, and don't offer it to another book until the first man has rejected it.

Ty's fourth point is not a rule. It's a whole section which he labels "How to Irritate Editors." (Most editors will tell you that we're often irritated enough without ol' smart aleck Hicks passing out free hints.)

These are the guaranteed irritants:

1. If you work for a manufacturing firm, threaten to cut your advertising space in the publication if the piece is rejected. (This is a sure way to alienate an honest editor, because you're saying that he is not the judge of what appears in his book, but merely sells it to the highest bidder. —And you're saying that his subscribers are clods who can't tell editorial copy from advertising copy. If you really want to make an editor mad, imply that his readers are saps.)

2. Crumble your photographs, drawings and copy. (As Brother Hicks says, if you've worked two months on an article, take another few minutes to see that the manuscript is wrapped to survive the mails.)

3. Pester the editor for a publication date. (Most magazines work on a schedule that provides a balanced diet for the reader. Other articles in the same field as yours may force postponement of publication for two or three issues.)

4. Complain if someone does a rewrite of your golden words. (Editors are trained to try to present material in a readable, easy, simple form. Every good editor reserves the right to rewrite. If you don't want your article touched, say so on submission. Nineteen times out of twenty, it will be rejected.)

5. Fail to read the final draft after it has been transcribed and then holler when an error appears in the article because the editor didn't catch it. (Any article goes through at least five people's hands. The cleanest, most precise copy stands the best chance of surviving the many opportunities for error to creep in. Dirty copy begs to be made worse.)

We'd like to add our own small piece of advice to the author who wants to see his material in print. The editor's intent is to present ideas which will help the reader in his work. If an author can gain prestige in his own firm or in the field, the editor shares his pleasure. But first, we must get through to the reader.

A public speaking prof of ours once gave us an axiom that applies equally well to writing:

Be polite; be sincere; be factual; be accurate; be friendly; and be seated.

The humorist H. Allen Smith tells a story which has bearing on the above problems. It concerns a little girl who received a free copy of a book from a publisher. Part of the gift was the proviso that the young lady fill out a card which gave her impressions of the book and return it to the publisher.

Her card read: "Thank you for the book about penguins. I have read it. The book has told me more about penguins than I care to know."

engine power BY CATERPILLAR

How Cat Diesel power pays off in industrial and mine locomotives

Today, not all industrial and mine locomotives have Caterpillar Diesel power. But the trend is definitely in that direction in locomotives up to and including 70-ton capacity. A locomotive assignment is no "bed of roses" for a diesel. That is why owners insist on the excellent productivity offered by Caterpillar. In both new locomotive purchases and in locomotive repowering jobs, men who demand more work from their diesels specify Caterpillar Diesel Engines.

If locomotives are a part of your production picture, these benefits of Cat power should be considered:

POWER RESERVE. Cat Engines deliver power needed to overcome adverse grades and bends. Their high torque rise and reasonable ratings will take heavy loads where "paper" horsepower is left behind.

WIDE RANGE OF FUELS. Cat Engines burn many fuels other diesels do not use. This non-premium appetite pays off in several ways: you can burn lower priced fuel . . . and you can burn heavier fuel (per gallon) with more resultant horsepower output.

FUEL BURNS COMPLETELY. The nonsensitive, foul-free Caterpillar-built fuel injection system gives complete fuel burning because of its precombustion chamber design. It transforms more of your fuel dollar to work and gives a clean exhaust that does not cloud up tunnels or foul up air underground. A variety of scrubbers, available for Cat Diesels, makes many of these engine arrangements permissible for use underground.

GOOD BREAKAWAY POWER. A Caterpillar Diesel-Torque Converter or Diesel Electric Drive enables a locomotive to break away large loads without an assist. This feature eliminates the high clutch costs on a direct drive installation. Most owners who have converted to these methods comment favorably on their advantages.

NEARBY PARTS AND SERVICE. Caterpillar Dealer Service facilities are available in all countries of the Free World—over 840 outlets place your Cat Diesel always near a parts and service source. This is why most manufacturers will offer Cat power when nearby parts and service are important factors.

HEAVY-DUTY DESIGN. The Cat Diesels that are offered for locomotive power are the same basic engines that have long been standards in the tough construction and mining industries.

Caterpillar Tractor Co., Peoria, Ill., U. S. A.

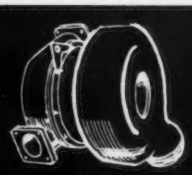
Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Caterpillar Dealers have cooperated closely with many large construction, mining and industrial companies on the solution to locomotive repowering problems. Your dealer will be glad to analyze your conditions and offer a repowering solution. For new equipment, contact your locomotive branch office or mail the coupon below.

Your Caterpillar Dealer Engine Specialist is your diesel power consultant. He's backed by quality parts, reasonably priced, and a skilled staff of factory-trained servicemen. Call him now to avoid problems later.

TURBOCHARGER — standard on most Cat Engines—gives more horsepower per pound of engine weight . . . improves efficiency by utilizing waste energy which reduces fuel consumption per horsepower-hour.

CDES



Dept. EM5, Engine Division
Caterpillar Tractor Co., Peoria, Illinois

Please have your representative get in touch with me and survey my locomotive power requirements. I am interested in diesel power for ☐ a new locomotive ☐ repowering an old locomotive. (If repowering, specify size of locomotive:_____)

Name_____

Company_____

Address_____

City_____ Zone_____ State_____

Special steels produce super savings

USS "T-1" Steel bucket sets performance records. This 15-cu.-yd. dragline bucket was rebuilt by the Hart and Hart Coal Company, Providence, Kentucky. They used ⅝" plates of USS "T-1" Steel for the bottom, sides and end in an effort to get longer service, and to eliminate expensive, time-consuming repairs.

The "T-1" Steel bucket now has had about five months of round-the-clock service in rock and shale and shows no signs of cracks or excessive wear—a record unequalled by any other bucket in their experience! USS "T-1" Steel's great strength, (100,000 psi min. yield) plus toughness, weldability and high resistance to impact abrasion, make it the ideal steel for mining equipment. Photo shows Mr. George Hart, co-owner of the coal company and Mr. Jesse O'Williams, his assistant.

in mining equipment

High Strength • Alloy • Stainless

Today's mining equipment will take more rough and tumble treatment, handle bigger loads and last longer than rigs built just a few years ago. Why? Because designers are using the toughest, strongest steels they can get to put more muscle into their products.

This means a better profit picture for you. Every pound of dead weight cut out of mobile equipment means that much added payload. Lighter equipment travels faster—earns more profits. More rugged rigs stay out of the repair shop and on the job. These are a few of the plus values you get from the new extra-strong, super-tough steels.

Here are the USS Steels that do more

USS MAN-TEN Brand—High strength with abrasion resistance and economy. (Minimum yield point 50,000 psi up to ½" thick incl.)

USS COR-TEN Brand—High strength with superior atmospheric corrosion resistance. (Minimum yield point 50,000 psi up to ½" thick incl.)

USS TRI-TEN Brand—High strength with toughness and abrasion resistance. (Minimum yield point 50,000 psi up to ¾" thick incl.)

USS "T-1" Brand—Super strength with impact abrasion resistance, toughness and weldability. (Minimum yield strength 100,000 psi or furnished to 321 min. Brinell hardness.)

USS STAINLESS—High resistance to corrosion, temperature, pressure, and abrasion.

Each of these steels has a combination of properties that makes it best for specific applications. Our metallurgists will be glad to help you choose the best steels for your job. Call our nearest Sales Office or write United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

USS, MAN-TEN, COR-TEN, TRI-TEN and "T-1" are registered trademarks

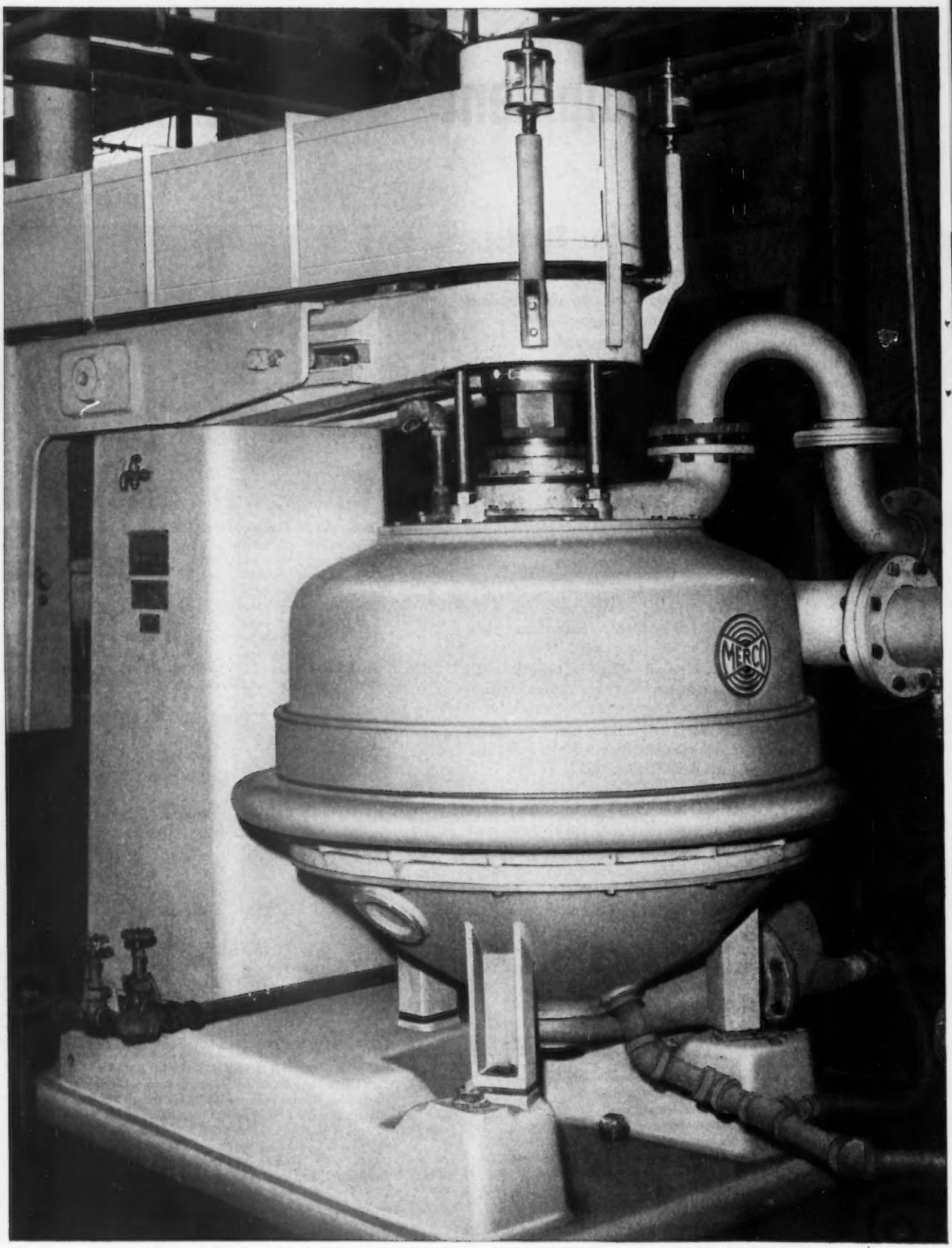
High Strength Steel rips through rock at 30 degrees below zero. The dozers, trucks and shovels used at this strip mine in Alaska have vital parts made from High Strength Steels. When it's 30 degrees below zero, and you have to rip through rock, field failures are frequent, but not with this equipment made from High Strength Steel.

The stronger, tougher USS Steels used for applications like this are USS MAN-TEN, TRI-TEN, COR-TEN brands with minimum yield points of 50,000 psi and USS "T-1" Constructional Alloy Steel furnished to 321 min. BHN or to 100,000 psi min. yield strength.

Stainless Steel coal screens outlast other metals 4 to 1. Tons of coal grind across this desanding screen every day. It gives excellent results because it's made from USS Stainless Steel Wire. Stainless Steel resists corrosion caused by wet coal. It keeps a smooth surface that lets coal slide easily, avoiding production-stopping build-ups. If you want longer service from your equipment—screens, flumes, chutes, shakers, vibrators, and jigs—specify USS Stainless Steel.

United States Steel Corporation—Pittsburgh
American Steel & Wire—Cleveland
National Tube—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel



New H-30 Merco Centrifuge, with increased speed and capacity, in operation at Argo, Ill. plant of Corn Products Refining Co.

NOW...

increased capacity in NEW MERCO CENTRIFUGE for nozzle bowl applications

Rotor speeds up to 3300 rpm and capacities up to 600 gpm are now possible with the new, improved H-30 Merco Centrifuge. At the same time, power requirements per gallon of feed have been substantially reduced.

In the first two installations, this new unit produced comparable removals at nearly double the capacity of previous models . . . and showed *no increases* in total power consumption.

This new operating efficiency is a result of improvements in rotor design, which provides greater disc area. Feed passages have been enlarged to accommodate increased flow.

The new Merco H-30 Centrifuge is particularly useful for clarification and thickening of slurries which contain fine solids (0.5 micron) over a wide range of feed solids concentrations (.02% and up). It is now available with a 30″ stainless steel rotor and bronze or stainless steel housing. In addition to its new large capacity and higher speeds, it contains these standard Merco benefits:

- The unique return flow principle that permits concentrating, washing, clarifying, classifying and recovery of soluble values at pressures up to 150 psi.
- No nozzle clogging or solids build-up in the unit.
- Overhead drive eliminates need for submerged bearing.
- Hydraulic hoist is built in to simplify inspection and maintenance.

If yours is a process that needs a large capacity centrifuge, there is a place for the Merco H-30 in your plant. For further information, write to Dorr-Oliver Incorporated, Stamford, Connecticut.

Merco—Reg. T.M. Pat. Off.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U. S. A.

EXPANDING in SERVICES and PRODUCTS

For the Mining Industries

National Mine Service Company

Seven major products distributed and serviced exclusively by National Mine

National Mine TorKar

With operation based on a single prime-mover and torque converter, AC, DC and Diesel-Powered TorKars are establishing new standards of shuttle car performance, with sharply reduced maintenance.

Greensburg Locomotives

From National Mine's Greensburg Division, a complete range of Monitor Type Storage Battery and Diesel Locomotives from 2 to 15 tons. More pulling power per ton, higher efficiency for every invested dollar.

Wheat National Electric Cap Lamp

A major advance in better light for the miner, incorporating significant new developments in battery, bulb and fingertip focussing—resulting in better light, greater utility, better service.

Scandura Belting

Stronger, lighter and more durable, fire-resistant P.V.C. Scandura is best for the long haul; best for extensibles! More productive because it stays on the job without expensive repair.

Clarkson Redbird Conveyor Chains

The leader in conveyor chain performance, with balanced construction providing longer, trouble-free service. Welded flight assembly lessens wear and strain, eliminates need for adjustment. A Clarkson Division product.

Hayden Belt Fastening Equipment

Using Tenex Hooks, the small, easily portable 17½-lb. Hayden "Autoclip" makes stronger conveyor belt splices in less time on the job and in limited working space. Material cost 25% lower, labor cost 75% lower—plus economies of reduced downtime.

Marietta Continuous Miner

This is a rugged, powerful, caterpillar-mounted, boring-type continuous mining machine of proven high capacity in coal and non-metallic mining—built by National Mine's Clarkson Division.

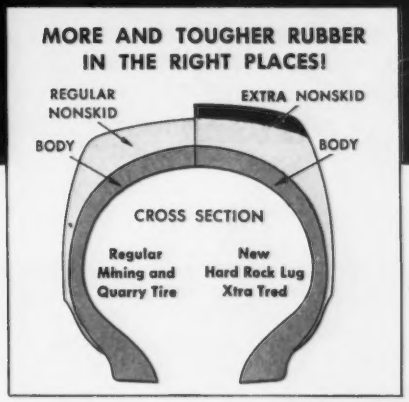
NATIONAL MINE SERVICE COMPANY

Koppers Building · Pittsburgh 19, Pa.

National Mine Service (Canada) Limited, Elliot Lake, Ontario

(3) MANUFACTURING DIVISIONS

(7) DISTRIBUTING DIVISIONS



ALL THERE FOR LONG WEAR

NEW HARD ROCK LUG XTRA TRED <u>has</u> it where mining and quarry tires <u>need</u> it!

The new Hard Rock Lug Xtra Tred is designed and built *specifically* for mine and quarry work.

Precise engineering of extra tread-rubber—extra-tough – results in up to 50% longer tread life! Reinforced lugs, bonus shoulder heft and huskier sidewalls endure unbelievably tough punishment.

And all this standout new tire engineering is backed by a body of Goodyear's exclusive Triple-Tough 3-T Nylon Cord—reduces bruise-breaks and blowouts to an all-time low—the greatest tire *saver* in 24 years!

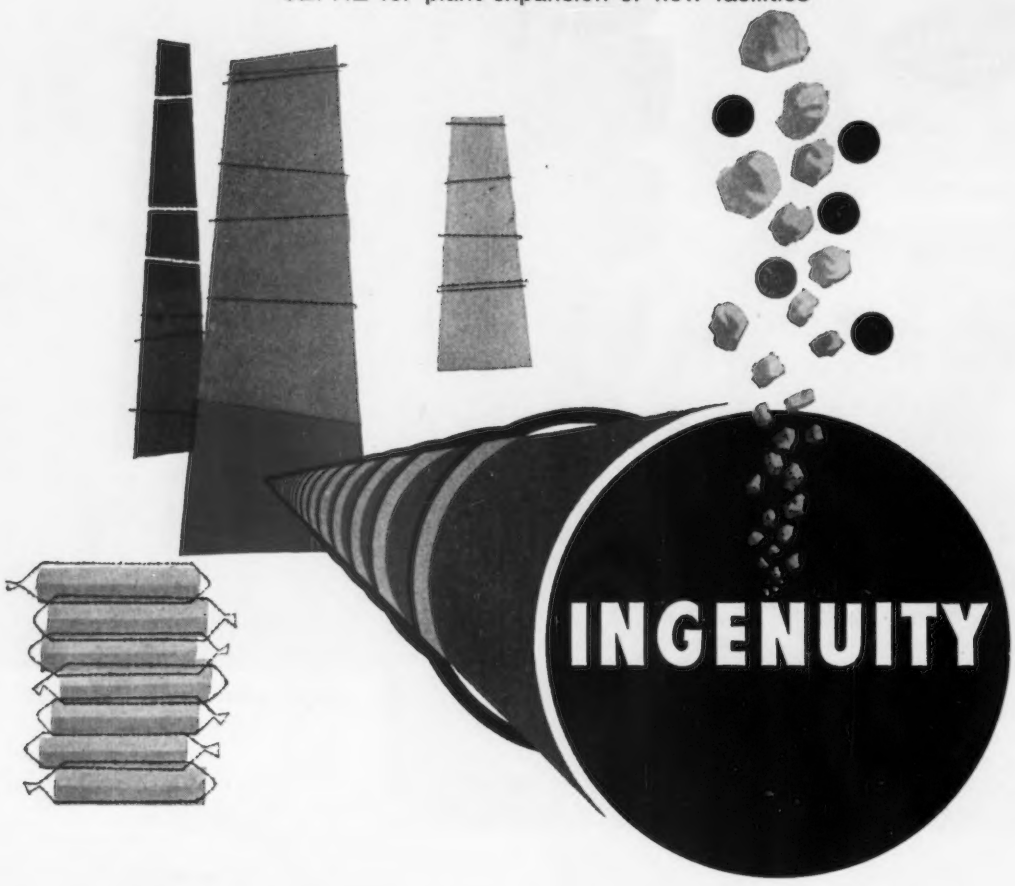
Better check into the new Hard Rock Lug Xtra Tred—at your Goodyear dealer's NOW! Goodyear, Truck Tire Dept., Akron 16, Ohio.

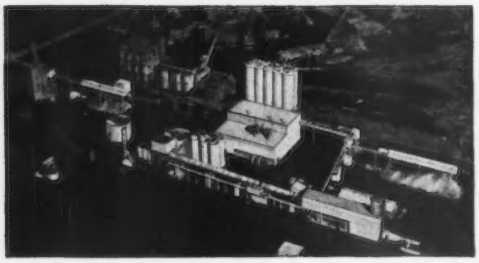
GOODYEAR

MORE TONS ARE HAULED ON GOODYEAR TRUCK TIRES THAN ON ANY OTHER KIND

Xtra Tred—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

call KE for plant expansion or new facilities





1,250,000 barrel cement plant addition recently completed by KE for Marquette Cement, one of world's largest cement producers.

has made KE a major engineer-contractor serving the Minerals Industry

Placing of four fully-lined mills in a few hours instead of days—a unique center pier kiln drive —a 2,700′ cement transport "airway." With these and many more planned innovations and short-cuts, Kaiser Engineers completed Marquette Cement's Cape Girardeau plant expansion quickly and economically. Construction cost and time were well below industry average.

Mining, transportation, beneficiation, materials handling, processing in cement, gypsum, coal, ferrous and non-ferrous metals facilities—these are but a few of the fields wherein KE serves the Minerals Industries—from economic analysis through start-up.

KE ingenuity—multi-industry experience, keenly applied—can benefit your next facility. Let us show you how.

KAISER ENGINEERS engineers—contractors
Contracting since 1914

Division of Henry J. Kaiser Company • Oakland 12, California • New York, Pittsburgh, Washington, D.C., Buenos Aires, Calcutta, Dusseldorf, Montreal, Rio de Janeiro, Sydney, Tokyo

NORTHWESTS play a part in the fast stripping schedule at LUCKY MC

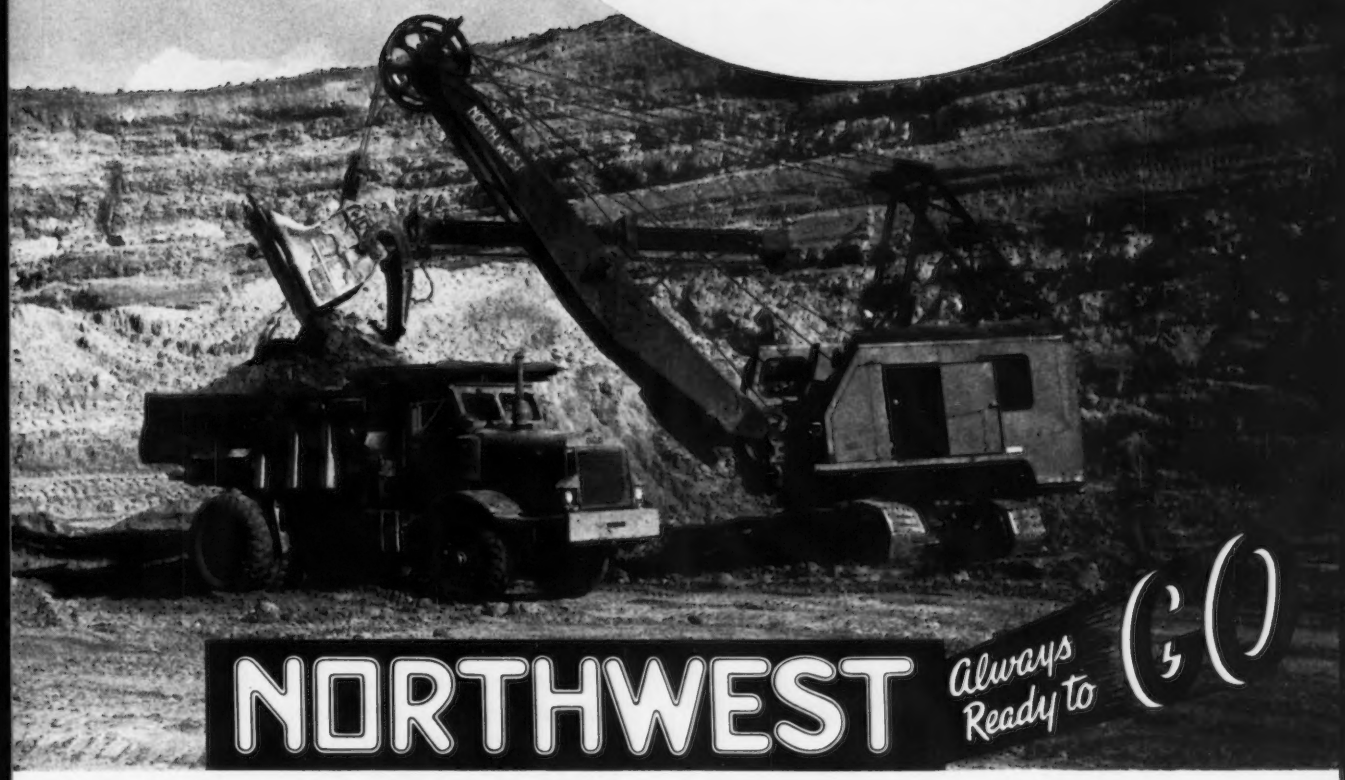
WHEN the Lucky Mc Uranium Corp. gets through at Riverton, Wyoming some of the standard texts on mining practice may have to be rewritten. Lucky Mc is the largest Uranium producer in Wyoming. The operation of the mine and mill are handled under contract by the Utah Mining Corp. and Utah Development Co., wholly owned subsidiaries of the Utah Construction Co. The high stripping ratio made a fast stripping schedule and selective mining a requirement.

Northwest Shovels of 2½ and 1½ yd. capacity play a large part in the mine output. Each project zone is equipped with one or more Northwest Model 80 or Model 6 Shovels. These machines handle the excavation in the hard formations.

Utah Construction Co. has been a long-time Northwest user and recently took delivery on their 57th Northwest. Many of these machines have been serving in the many mining operations of the Company.

Your Northwest will prove itself a *real* Rock Shovel. It has been built for the hardest digging a shovel will encounter. The Northwest Dual Independent Crowd that utilizes force most independent crowd shovels waste; the "Feather-Touch" Clutch Control; Uniform Pressure Swing Clutches; the Cushion Clutch; power plants that serve smoothly in high altitudes and many other Northwest features combine to give trouble-free service and high output in those often inaccessible areas characteristic of mining. There is a great deal to the Northwest story. Let a Northwest man give you the details.

NORTHWEST ENGINEERING COMPANY
1509 Field Bldg., 135 So. LaSalle St., Chicago 3, Ill.



NORTHWEST Always Ready to GO

NORTHWEST EQUIPMENT IS BUILT IN THE FOLLOWING SIZES

SHOVELS	CRANES	DRAGLINES	PULLSHOVELS	TRUCK CRANES
¾ Yd. to 2½ Yd. Capacity	13-Ton to 50-Ton Capacity	¾ Yd. to 3 Yd. Capacity	¾ Yd. to 2½ Yd. Capacity	25-Ton and 35-Ton Capacity

S-80-87-L

"Our Ford F-800's, pulling 20-ton payloads, give us mighty good service!"

says R. Dillard Teer, Vice President
Nello L. Teer Co., Durham, N. Carolina

"We operate about 115 Ford Trucks ranging in size from ½-ton pickups to Tilt Cab Tandem tractors. We believe in carefully fitting the truck to the job to be done and usually stay within the manufacturer's recommended ratings. We make an exception to this rule with our Ford F-800's, pulling 20-ton loads in aluminum trailer dumps to our quarry and crushing setup at Durham, North Carolina. These units are carrying the maximum legal limit and give us mighty good service!

"We haven't traded any trucks in about 6 years. It just happens that our company has been growing so rapidly that when we buy a new truck, usually an F-800, I put it under one of our trailer dumps. Then I'll take the old truck, lengthen the chassis, and make a grease outfit or a water wagon out of it. I would say out of over a hundred Ford units in the past 7 or 8 years, we have gotten rid of only a dozen altogether—and some of these were wrecked or burned.

"Another reason we use Fords is that this business is rough on trucks, so parts availability is very important. Our experience over the years with Ford as compared to Ford competitors has been definitely in favor of Ford on parts."

Capacity Capacity Capacity Capacity Capacity

S-80-97-L

NOW! CERTIFIED PROOF!

FORD TRUCKS COST LESS

'59 Ford Pickups beat average mileage of other leading makes by 25.2% in Economy Showdown U.S.A.

Here at last is certified proof of the differences in gas mileage between six-cylinder pickups . . . evidence that you can use in your operation.

It was compiled by America's foremost independent automotive research firm after testing 1959 six-cylinder, ½-ton pickups of the six leading makes. All trucks were bought from dealers—just as you would.

The tests paralleled every kind of driving – high speeds and low, open highways and city traffic, even door-to-door delivery. And in every test, '59 Ford Sixes delivered more miles per gallon than any other make. Here are the actual percentages:

'59 FORD PICKUP SIXES GAVE

42.6% better mileage than make "D"
31.1% better mileage than make "I"
25.2% better mileage than make "C"
22.0% better mileage than make "S"
9.6% better mileage than make "G"

Taken together, Ford got 25.2% more miles per gallon than the average of all other leading pickups!

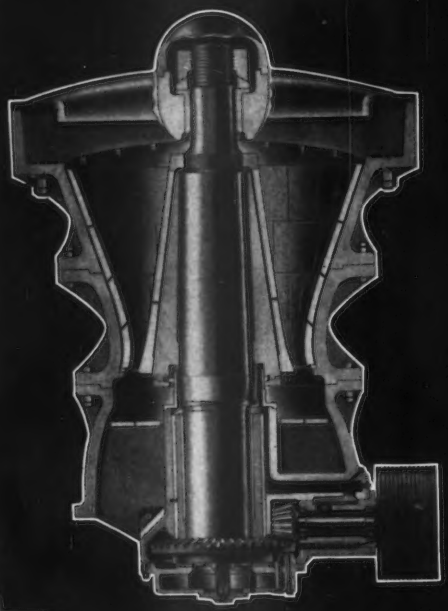
What's the secret of Ford's economy? First, of all pickup sixes, only the Ford Six has modern Short Stroke design which reduces friction and requires less fuel. Second, to this modern engine, Ford has added a new economy carburetor to meter fuel more precisely in both high- and low-speed ranges.

See your Ford Dealer for the full report of Economy Showdown U.S.A. and get the whole story firsthand.

All tests conducted and results
CERTIFIED
by America's foremost independent automotive research organization*
***NAME AVAILABLE ON REQUEST**
Send inquiry to P.O. Box 2687, Ford Division Ford Motor Co., Detroit 31, Michigan

Now! During Dividend Days at your Ford Dealer's...Go *FORD*-ward for Savings

TC GYRATORY CRUSHERS



Traylor-made for primary reduction

Traylor engineers are the world's largest builder of giant 60" Gyratory Crushers. Here are some of the reasons the Traylor TC Gyratory Crusher is so much in demand:

- A straight line bar type spider, of heavy construction—simple but strong.
- Traylor original, self-tightening, bell head and curved concaves.
- The Traylor patented dust seal. A practical and efficient device for excluding foreign matter from the lubrication chamber.
- A positive outside automatic lubrication system.
- Bronze bushed eccentric bearing with pressurized lubrication.

. . . made in 7 sizes with feed openings 20" to 60" and capacities from 1,240 to over 32,000 tons per eight hour day are in use by many leading producers throughout the world.

For specifications and capacities, send for Traylor Bulletin No. 1126.

Shown above a 54" TC Gyratory Crusher in a portland cement plant.

GYRATORY CRUSHERS • JAW CRUSHERS
Traylor
ROTARY KILNS • BALL MILLS • APRON FEEDERS

TRAYLOR ENGINEERING & MFG. CO., 1151 MILL ST., ALLENTOWN, PA.

Sales Offices: New York — Chicago — San Francisco

Canadian Mfr.: Canadian Vickers, Ltd., Montreal, P.Q.

3

New International® Earthmovers

new CAPACITIES (24 yd. scrapers, 27 yd. wagon)

new POWER (375 hp)

new SPEEDS (to 29.1 mph)

Higher speeds possible with optional equipment.

International 24 cu. yd. 295 Payscraper

Heaped: 31 cu. yd.
Overall length: 44'8".

New high visibility color. Optionally available on all three models in either Federal yellow or International Harvester red.

NEW positive push-type ejection assures quick clean dumping of all materials.

NEW advanced lift frame construction with A-frame-type gooseneck that: 1) increases visibility; 2) distributes weight evenly along cross tube; and 3) protects sheaves of bowl lift system.

NEW full 90° turns with power steering.

NEW 375 hp DT-817 turbocharged 6-cylinder diesel engine. See page 4.

NEW cycle-shortening haul speeds to 26.2 mph plus unmatched maneuverability.

NEW exclusive tapered bowl. See next pages.

NEW high 98″ apron opening. See pages 2-3.

NEW automotive comfort and control features . . . 16-adjustment bucket seat . . . reach-easy controls . . . unobstructed vision . . . air brakes . . . flush deck.

NEW Model 280 cable control unit . . . finger-tip control . . . fast acting . . . high capacity . . . simple adjustments . . . less maintenance.

See 3-axle models on inside pages...

27 CU. YD. International 495 Paywagon®

Heaped: 40.5 cu. yd.
Payload: 40.5 tons.
Overall length: 50'4½".

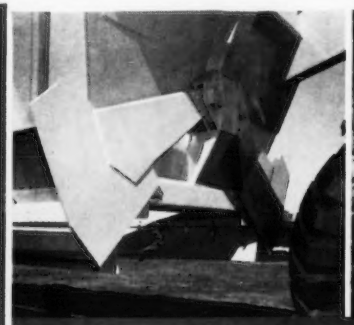
Here in the *27 cu. yd.* International 495 Paywagon is everything that's new and productively *different* in bottom dump design. New 375 hp engine for greater power *per struck yard than any comparable rig.* New higher side and rear end clearance to roll away from any dumped load. New power-opened clamshell doors for positive controlled dumping. New wiper plates put 100% of each load on the fill. New automotive comfort and control features *that* let the operator produce more with less effort. New full 90° turning in either direction. New low design for haul road stability.

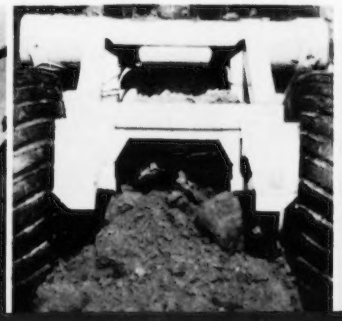
New exclusive power-opened clamshell doors afford positive controlled dumping. Operator spot dumps entire load or windrows material in lifts from a few inches on up. Wiper plates shave all material from doors as they raise. Doors gravity close, eliminating complicated mechanism.

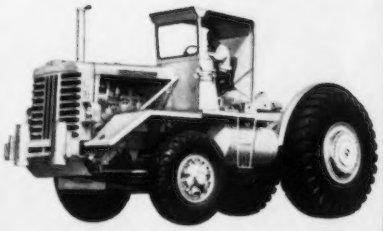
Unmatched 60" rear end dumping clearance lets rig pull fast from fill with no dangling doors dragging on dumped material. Open rear frame lets loader spillage fall through — prevents buildup of "free loading" material.

375 HP 495 prime mover gives both 495 Paywagon and 495 Payscraper more hp per struck yard with less gross weight per hp than any similar sized earth mover. Speeds to 29.1 mph. 10'8¼" wheel base. Full 180° non-stop turns can be made within 39'11¾".

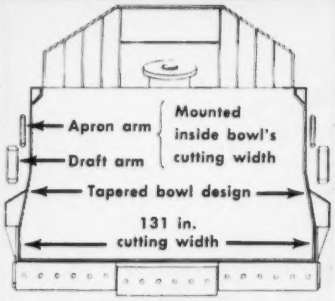
NEW high speeds big capacities

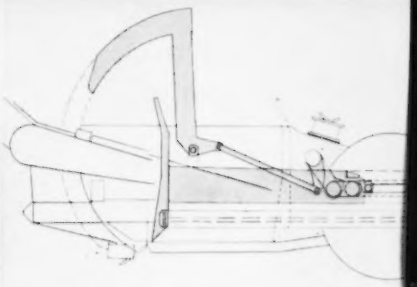






fast dumping
unmatched control





This new International 495 Payscraper boils a heaped load into a 24 cu. yd. bowl in less time than any other three-axle scraper in its class and hauls it at speeds up to 29.1 mph. The trailing unit, common to the 295 Payscraper, offers this unmatched combination of features that cut dirt costs: big 131-in. cutting width . . . tapered bowl permits efficient ejection of all materials with equal ease . . . positive forced ejection . . . improved lift frame construction . . . full 90° turns . . . more hp per struck yard than all competitive units . . . wheels and bowl leveling adjustment . . . advanced sheave bearing design . . . and custom designed cable control unit.

Exclusive tapered bowl design: 1) permits scraper and pusher to work inside cut for best traction, less wear on tires, and tracks, 2) causes dirt to boil toward center, reducing side spillage; 3) extra wide bowl bottom provides wider spread, speeds dirt breakaway and lets scraper work cuts against banks.

Positive forced ejection dumps all materials — even wet or frozen clay and gumbo — cleanly and quickly. Six large ball bearing mounted rollers center and guide ejector gate, have 240-hour lube intervals.

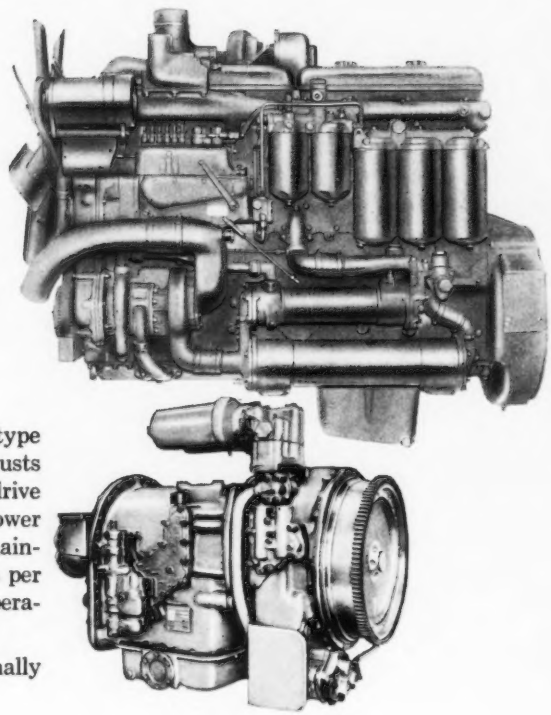
Gaping 98" apron opening plus no bowl cross member permits sure ejection of all materials. Apron opened by exclusive, rear-controlled mechanical linkage. Apron is synchronized with ejector for positive controlled spreading.

24 CU. YD. International 495 Payscraper

Heaped: 31 cu. yd.
Overall length: 50'6¼".

New Turbocharged International DT-817 powers all three giant earthmovers

- Develops 375 hp @ 2100 rpm
- Direct push-button, 24-volt starting
- Positive valve rotators — increase valve life
- Aluminum alloy pistons for fast heat dissipation
- Wet sleeve construction provides additional cooling
- Fully counterbalanced crankshaft for smooth engine performance
- Dual intake and exhaust valves for peak engine efficiency
- Twin plunger injection pump precision meters fuel
- Hang down type replaceable filters for maximum fuel and oil filtering efficiency
- Tri-metal crankshaft bearings for long trouble-free service



Both prime movers are available with 4-speed, planetary type torque converter power shift transmission. It automatically adjusts output torque and speed to fit load requirements. Torqmatic drive makes more power available over the entire range; applies power smoothly and continuously, resulting in less wheel slippage; maintains high tractive effort; and cuts the number of gear shifts per cycle, letting operator concentrate on loading and spreading operations.

A constant mesh 9-speed manual shift transmission is optionally available on both prime movers.

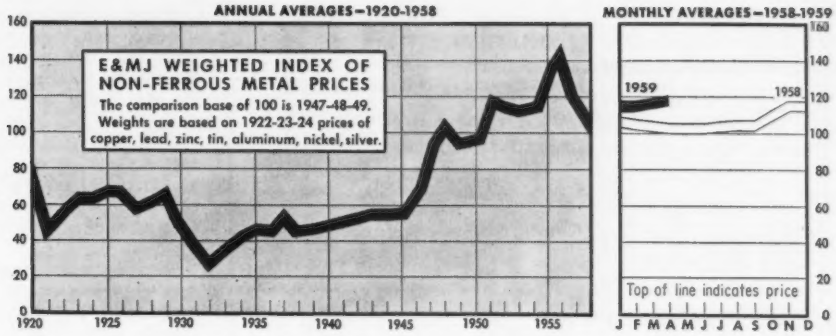
See your International Construction Equipment Distributor for complete information on these NEW International Earthmovers

International® *Construction Equipment*

International Harvester Co. • 180 N. Michigan Ave., • Chicago 1, Ill.

A COMPLETE POWER PACKAGE: Crawler and Wheeler Tractors . . . Self-Propelled Scrapers and Bottom Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

E&MJ OUTLOOK



MARKETS

Higher copper prices offset lead and tin price drops, and moved E&MJ's metal price index slightly upward from 119.9 for March to 120.1 for April. Zinc, silver, nickel and aluminum were unchanged.

•

AT HOME

E. J. Lavino and Co. announced plans to build a $3-million plant at Freeport, Tex., for the production of high-grade magnesite (periclase) a component of refractories. Dow Chemical Co. will supply the magnesium hydroxide from its Freeport plant.

Miami Copper Co. will terminate underground mining at its Arizona copper mine in mid-1959. A large portion of the remaining copper in the property will be recovered by the more economical in-place leaching process.

Another round of wage increases in the U.S. "will chop off another segment of America's profitable exports and create more unemployment in factories here in the U.S.", in the opinion of W. L. Wearly, president of Joy Mfg. Co.

Steel output in March was 11,567,000 tons—an all-time high. This rate is expected to continue through May and June.

Phelps Dodge Corp. plans to expand the Lavender pit at a cost of about $5-million.

Kennecott Copper Corp., through its Bear Creek Mining Co. subsidiary, announced that it intends to exercise options to purchase 120 acres near Safford, Ariz. Considerable additional exploration work will be required before the company can formulate plans for the property.

•

LABOR

International Union of Mine, Mill & Smelter Workers bargaining demands include "a substantial wage increase", a 32-hr week with no reduction in pay, overtime at time and one-half, double present night-shift differentials, a wage escalator clause, and a supplementary benefit plan.

•

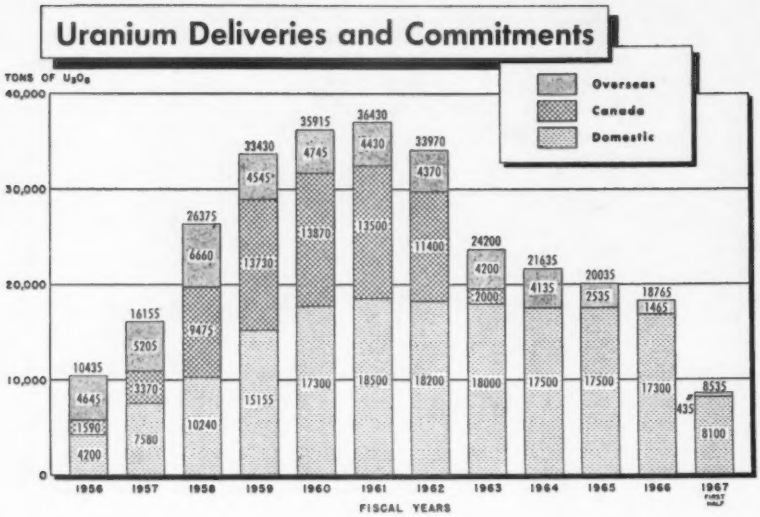
ABROAD

Claim staking is increasing in Ontario. Claims staked during the first quarter of 1958 totaled 4,914. For the first quarter of 1959 the total was 6,848.

Indicated ore at the Rio Blanco property in Chile, in which Cerro de Pasco Corp. holds certain options, totals 112-million short tons with an average grade of 1.6% copper, of which 81-million tons are considered to be proved. Tentative plans call for mining the deposit by block caving at a rate of about 11,000 short tons per day.

One of the world's largest iron mines, the "Gigant Glubokaja," is under construction in the Krivoj Rog area, Southern Ukrania. By the end of 1961, the mine is expected to yield 7.4-million metric tons annually.

THIS MONTH IN MINING

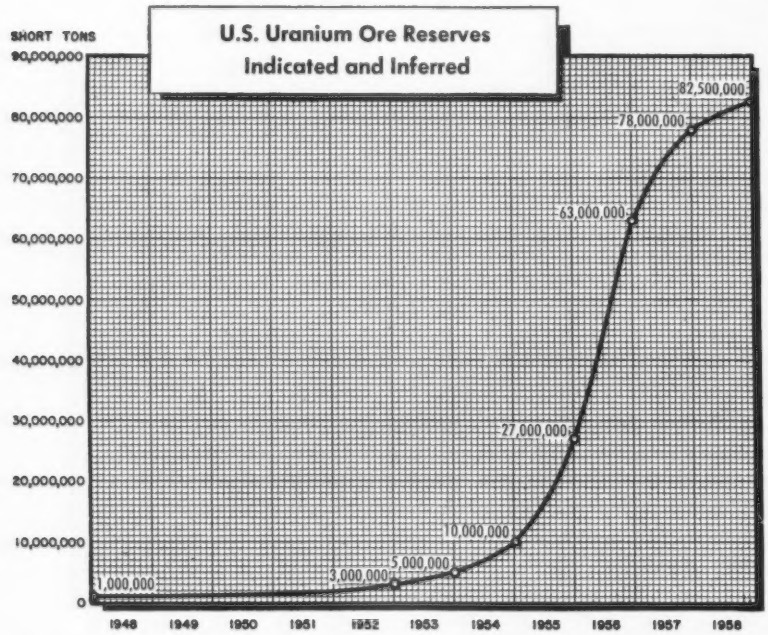


Wyoming Miners Hear Johnson

THE RAW MATERIALS DIVISION of the Atomic Energy Commission doesn't project purchase of uranium concentrates from Canadian sources beyond existing contract dates, the fourth annual convention of Wyoming Mining Assn. (April 16-18) was told. Some 350 uranium miners and representatives of coal and industrial minerals operations were informed by Jesse Johnson, director of the division that:

"From the beginning of the atomic energy program to July 1, 1955, 83% of the total uranium purchased by the U.S. came from foreign sources.

"Between July 1, 1955, and June 30, 1962, 47% of our total uranium purchases will be from domestic sources and 53% from foreign. A large part of the foreign material is Canadian. Most of our Canadian contracts expire March 31, 1962, with only about 2,000 tons to be purchased between March 31, 1962, and March 31, 1963.



"Now let us look at our outstanding contracts and commitments for the period June 30, 1962, through Dec. 31, 1966. Eighty-four percent of the uranium which the AEC now is committed to buy in this period will come from domestic sources. The AEC has options for extending its Canadian contracts through 1966 at $8. (U.S.) per lb of U_3O_8 in a mill concentrate. There is no commitment to exercise these options which expire March 31, 1961.

Mr. Johnson attached the above graphs to his speech, which are based on the current national situation and current commitments.

The graphs disclose that the U.S. AEC will be buying 36,430 tons of U_3O_8 in peak purchase year of 1961. Of that amount, 18,500 tons will come from U.S.; 13,500 tons from Canada and 4,430 tons from overseas sources, principally from South Africa.

Mr. Johnson's presence at the meeting underscored the AEC's interest in Wyoming's uranium reserve development —where ore is being discovered at a rate faster than probably any place in the world.

AEC gives Wyoming 12-million tons of 0.31% U_3O_8 uranium reserves, making it second in the U.S. Mr. Johnson told *E&MJ*, however that he would not "object" to an estimate of another 3-million tons of uranium running an average of 0.60% U_3O_8 for the new Shirley Basin Field.

He toured the field with AEC officials from Grand Junction Operations Office and in his formal speech to the association said: "This new field, upon full development, may be one of the largest in the country."

Johnson said that the Shirley Basin development and the discoveries in the Gas Hills and Ambrosia Lake district, etc., convinced him that "the uranium yet to be found (in the U.S.) is many times the presently developed reserves, which numbered 82.5 million tons at end of 1958.

"Although the U.S. is third to Canada and South Africa in uranium reserves, we are in a position to add to our ore reserves more rapidly than almost any other country," he said.

"Considering our reserves and potentialities, it is to be expected that this Government's uranium procurement program will be based primarily upon the utilization and development of its domestic resources, if our cost of production is competitive—and it is," he said.

"Foreign producers should not object to this policy. The criticism directed toward our tariffs on mineral products is that we subsidize uneconomic domestic producers at the expense of competitive world trade. Whatever may be the arguments for and against this criticism, it does not apply to our uranium production," he said.

Our domestic uranium industry under recently announced programs has a market through 1966 which will average

nearly 18,000 tons of U_3O_8 per year. As a result of a limited deferral program, involving only large companies and none of the small independent miners, we now expect to arrange reasonably uniform annual deliveries over the entire period. Wyoming producers are not included in these stretch-out negotiations because uniform annual delivery rates were considered in recent negotiations for additional production. Domestic production is estimated to reach a maximum of 18,500 tons of U_3O_8 in fiscal year 1961 (without deferral annual production during the next three years would be in excess of 20,000 tons).

Even with this limited domestic deferral, the AEC's uranium purchases, including domestic and foreign, in the next three fiscal years will average about 36,000 tons annually, which is in excess of the planned requirements for those years. A uniform delivery rate through 1966, based upon the current estimate of outstanding commitments, would be approximately 27,000 tons a year.

Later, at a press conference, Johnson conceded that there were probably some (not all) producers in South Africa who because of co-output of gold could elect to sell uranium concentrates for whatever price they wanted after 1966.

He noted that the huge South African gold-uranium plant complexes would be amortized by this period, that such amortization could also play a role in future pricing of uranium on the world market. He is convinced, however, that majority of U.S. production would be at costs under those enjoyed by Canadian mines which are generally deeper and of lower grade than those in America.

Mr. Johnson presented a stirring defense of AEC policy, asserting that no government agency concerned with development of mineral procurement had

(Continued on page 167)

Mining Calendar

Southern Metals Conference, sponsored by Savannah River Chapter, American Society for Metals, Augusta, Ga. May 4-6.

Uranium Section, AIME, Moab, Utah May 8-10.

35th Annual Conference of Lake Superior Mines Safety Council, Hotel Duluth, Duluth, Minn. May 21-22.

"The Undiscovered Earth" conference Southern Research Institute, Birmingham, Ala. June 11-12.

Open Pit Mining Association, annual meeting, Rolla, Mo. June 18.

Air Pollution Control Association annual meeting, Hotel Statler, Los Angeles, Calif. June 22-26.

Institution of Mining Engineers Symposium on Shaft Sinking and Tunnelling, Olympia, London, July 15-17.

1959 Convention, American Mining Congress, Denver, Colo. Sept. 14-17.

Annual meeting, AIME, New York, Feb. 14-18, 1960.

(Continued on p 118)

As We Went to Press . . .

With her national ensign hung across the bow, the first salt water-going vessel to enter the St. Lawrence Seaway started through the locks below Montreal behind the Canadian icebreakers *d'Iberville* and *Montcalm* on April 25.

The Netherlands ship *Prinz William George Fredrik* led the way to the opening of Great Lakes ports to two-thirds of the world's shipping, and to the waterway which will connect Canada's great ore fields with the steel plants of the Midwest.

Official dedication of the Seaway Project, which also supplies hydroelectric power to aluminum projects in its area, will take place June 26.

Delhi-Taylor Oil Corp. has announced that a report by mining consultants confirms its estimates of a high grade, "valuable" potash reserve south of Moab, Utah.

A $20-million nickel refinery is underway at International Nickel Co.'s Thompson Mine in Manitoba. The plant is expected to produce 75-million lb of nickel per year from the Moak Lake-Mystery Lake ores.

The first session of the first Alaska state legislature confirmed the appointment of Phil Holdsworth, Juneau, as commissioner of the new Natural Resources Department. Holdsworth, a mining engineer and a top authority on mineral leasing problems, has been commissioner of mines for the former territory of Alaska since 1952.

At Anchorage, the president of Alaska Oil and Mineral Co., in an address to the local Chamber of Commerce, offered a warning to speculators. He predicted that some investors face disillusionment if they believe tales of glowing profits and do not consider the rugged terrain and great transportation problems of the far North. If overenthusiastic promoters harm the good will of investors, he said, then "nothing can be sold."

Mitsubishi Mining Co. and Mitsubishi Trading Co. have concluded a $1.5-million purchase of Las Adrianitas iron mines, near Copiapo, Chile.

A new firm, Sociedad Minera Atacama, will operate the mine with Japanese equipment, starting in June, and hopes to begin shipment of 350,000 tons of iron ore per month to Yawata Steel's mill, in Japan, by July. Mitsubishi said the mines have reserves of 10-million tons of 67% Fe ore.

Passage of a labor reform bill by the present Congress is considered very likely, despite House opposition to the Senate-passed Kennedy-Ervin bill because it is "too moderate."

Public reaction to Sen. John McClellan's racket committee hearings was strong, and the pressure is on Congress to come out with a legislative answer.

Lisbon Uranium Corp. has started work on the deepest uranium shaft in Wyoming. The shaft, now down to about 60 ft, will be concrete lined, and will reach 500 ft at completion.

WASHINGTON IMPACT

Highlights

STOCKPILE DISPOSAL FIGHT—The Government's final solution to the problem of surplus metal-mineral commodities will take awhile to hammer out. The fundamental issue goes far beyond the violent scare that was thrown into the world copper markets last month, when word leaked out that Washington was ready to unload 128,000 tons of the metal in its Defense Production Act inventories.

Administration agency heads and advisers are sharply split on how stockpile disposal should be handled, if at all. But the basic question cannot be begged indefinitely. Sooner or later the Government will have to make up its collective mind, and some disposal of some stocks of some metals is generally regarded as an eventual must.

Following a Cabinet meeting April 24, an announcement stated that no release from the DPA, or any other, stockpile was contemplated in the "foreseeable future," but the larger question remains. (See story on center columns.)

The announcement was an informal one, but was obviously prompted by the reaction in world markets to rumors that stockpile copper might be released.

The Cabinet meeting may have been partially influenced by a Senate resolution which said sale of the copper would "raise incalculable danger to the national security and economic well-being" of the United States.

FACTORS FAVOR DISPOSAL—The whole problem of selling off unneeded supplies ties into two basic theories of the Administration. One is that defense requirements—both military and civilian—should be based on the so-called short-war theory, that is that in today's nuclear age, stockpiling policy should be geared to the needs of a quick and decisive war.

Beyond that, the Government now holds stocks of a number of commodities—including copper—that exceed any conceivable needs for even a long war, or an indefinite series of "brush-fire" actions.

The other theory that threads through every Eisenhower Administration policy is that the Government should cut costs wherever possible. While it is conceded that metal stocks do not cost much relatively to maintain, the mere ownership of surplus supplies represents an economic drain.

It was Treasury Secretary Robert Anderson and Budget Bureau director Maurice Stans who first supported the copper disposal plan, although Anderson reportedly changed his mind subsequently. Office of Civil and Defense Mobilization director Leo Hoegh also backed the copper release on grounds of boosting Government revenues as well as in line with OCDM's short-war philosophy which dates back to the support for that view in the Pettibone Special Stockpiling Report.

As the copper release squabble underscored, the Government needs direct Congressional approval to sell off any of its stocks held in the national (long-term) or strategic (short-term) stockpiles. But it does not need an okay on Capitol Hill to release inventories of materials bought under Defense Production Act incentive purchase programs.

Actually, the DPA inventory release was proposed as a compromise solution to OCDM consideration of asking Congressional approval for release of stockpiled copper.

This, more than any other aspect of the befuddled copper hassle, shows that the Administration is considering, and will continue to consider release of more than DPA inventories, and more than just copper.

OPPONENTS PROVIDE BRAKE—The agency is of course pledged to do nothing to "disrupt normal commercial" markets. This, plus close Congressional watchdogging of any disposal policy that may shape up in the future, will act as a brake on the Government's efforts to unload. In the Senate especially, where small domestic mine representation is relatively powerful, this brake will be applied heavily. But the trend is toward disposal. The Pettibone report, plus recent British government sales of its surplus commodities, plus current philosophies of the Eisenhower Administration, added to the copper incident—all point to an eventual showdown on Government disposal policy which is considered in Washington to result in at least some Government sales.

Cabinet Quells Fears Of Copper Stocks Sale

THE QUESTION of Government disposal of surplus copper stocks boiled up to cabinet level in Washington last month, with the Administration split sharply within its own ranks on the right answer.

As this issue of *E&MJ* went to press, this is how the issue stood: Office of Civil and Defense Mobilization director Lew A. Hoegh, backed by Commerce Secretary Lewis Strauss and Budget Bureau director Maurice Stans, firmly asserted his agency's right to dispose of surplus commodity supplies "in orderly fashion" in such a way as not to disrupt normal commercial markets. This right, of course, applies to materials held in the so-called DPA inventories—commodities bought under Defense Production Act incentive purchase programs not yet transferred to the national (long-term) or strategic (short-term) stockpiles. Stockpile releases must have specific Congressional authorization on the floor of both houses.

At a special Cabinet meeting held Friday, April 24, Administration officials discussed the problem and publicly reassured the industry in an informal statement that there will be no release from the stockpile "pipeline" at the present time, nor is any planned in the "foreseeable future". While the statement cleared up the present confusion, observers generally agree that the conditions which caused it remain unsolved.

In his stand, Interior Secretary Fred Seaton was backed by Under-Secretary of State C. Douglas Dillon in opposition to the release of any copper at this time, because of the obvious international market effects such sales would have.

When word leaked out of Washington last month that the OCDM was considering unloading part or all of its 128,000 tons in inventory, metal exchanges in New York and London skittishly reacted by registering new post-recession lows for both producers' and custom smelters' copper.

On top of this opposition, reflecting both domestic and foreign copper producers' concern, mining-state senators led by Sens. James Murray, and Mike Mansfield (D-Mont.) were pressing legislative steps to stop the Government from selling any copper whatsoever.

Sen. Murray is behind legislation to write into law a direct prohibition against selling off even inventory stocks without the approval of the Senate and House Interior committees.

Hoegh and other OCDM officials had given up any idea of unloading the whole 128,000 tons. Hoegh's earlier statements that OCDM still might sell some copper were limited to the possibility of releasing 5,000 tons per quarter on the open market.

Actually, Congressional sources got an advance tip that OCDM was considering copper sales. OCDM sounded out Congressional sources before the word got around on the release order.

OCDM and the Commerce Dept. favored the move to help copper fabricators who complained of an impending supply shortage. The Budget Bureau, and originally the Treasury Department as well, supported the move in a desperate search for new sources of Government revenue to help bring the budget into closer balance. Later Treasury changed its mind when it saw the adverse market reaction.

Fluorspar Bill Is Held In Committee Squabble

THE BILL to restrict imports of fluorspar (*E&MJ*, April 1959, p 20), is bogged down in a Senate committee squabble. After concluding hearings last month which registered strong Government and industrial users' opposition to the measure, the Senate Interior Committee was asked by the Senate Finance Committee to give up its right to send the bill to the floor.

Behind the move are two members of the finance group—Sens. Paul Douglas (D-Ill.) and John Williams (R-Del.). Douglas favors less restrictive trade policies, and Williams has a record of opposing mining support legislation.

Upshot is that the Senate finance group may get the bill, but mining experts think they have the votes to still get the legislation reported to the full Senate.

At Interior Committee hearings, Administration witnesses explained their opposition to this bill while they supported relief for fluorspar last year, on grounds that the recession is over and new demand will erase need for aid.

They also pointed out that fluorspar import protection is pending in an OCDM petition for relief on grounds of defense essentiality.

Ghana's Aluminum Project Interests Washington

ALUMINUM PRODUCERS IN THE U.S., Canada and possibly Europe as well, are taking a new look at the tiny West African state of Ghana as a potential aluminum production site.

The Volta development previously was considered uneconomic in light of the $900-million a British engineering firm said it would take to provide 700,000 kilowatts of electric power. Kaiser, however, now estimates a 768,000-kw capacity system can be built for $156-million, by delaying subsidiary plans for roads and other facilities, and moving the prospective damsite to a faster-flowing part of the river. (See This Month in Mining)

What has Washington and London interested in helping finance the whole project is the obvious political benefits.

Future private investment is based on expanding European aluminum needs, not on potential shipments to the U.S., where mining-state Senators are rumored readying a new bill to curb aluminum product imports.

Labor This Month

NONFERROUS PRODUCTIVITY—What it looks like: In the upcoming wage negotiations in the nonferrous mining industry, a key issue will be productivity. Officials of the industry and the Mine-Mill and Smelter Workers union will be basing demands—in part—on what has been happening to worker output in the mines. Now, Government economists have come out with the official figures on man-hour output per worker through 1958. And, they take a good guess about what's happening this year in the advance of bargaining. The productivity evidence will be used by both sides—and it offers mixed bargaining blessings for both.

PRODUCTIVITY FOLLOWS THE BUSINESS TURNS: Worker output has sagged in the 1958 recession period; it is booming in the 1959 recovery. The figures, produced by the Bureau of Labor Statistics, show this general trend. Thus, the industry negotiations can argue that the increases under the three-year contracts with MMSW have called for good wages while worker output has fallen off for part of the time. The union will counter that this is past—that 1959 bargaining should be matched to 1959 productivity.

Here's what the official figures show: (1947 = 100)

	Copper	Iron	Lead and Zinc
1955	120.4	117.1	116.6
1956	116.1	109.8	117.1
1957	125.7	107.9	123.0
1958	139.1		

While lead-zinc and iron 1958 rating isn't yet in, nor are the 1959 trends so far, BLS Commissioner Ewan Clague offers some good guesses on what is happening. Clague notes what has happened in previous recession-pickup periods since 1947. Productivity tumbled in bad business years and climbed quickly as business picked up. As a consequence, he warns that negotiations can't be based on particular industry rating, nor even on the over-all average of industrial productivity but "by the competitive situation."

PRODUCTIVITY—THE BARGAINING BYWORD: Despite Commissioner Clague's admonitions about using his Bureau's output figures, this will be the focal point of some expected hot metal bargaining. Even President Eisenhower warns that 1959 negotiations should reflect productivity levels; that this should be a controlling and stabilizing factor.

Mine-Mill officials have their own pre-bargaining goals on productivity set in order. Here's what they say: copper hit production peaks in late 1958, with 7,000 fewer workers. And that 1959 looks like a record-breaking year with a smaller payroll—"A basic imbalance that we will seek to adjust in this year's bargaining." They top this with the claim that the current three-year contracts which expire at mid-year did not provide their members "with an adequate share of the gains of rising productivity."

LABOR REFORM—A CONGRESSIONAL TALK-A-THON: Whatever else happens, the 86th Congress will be well-versed on the subject of anti-racketeering labor legislation. It is getting more vocal treatment than any proposed labor bill in years. But, it may come out "all bark and no bite." Despite the Senate's concern over putting through a bill to President Eisenhower's desk, the House doesn't feel the same determination. There are a couple of important reasons for this—and they may spell the end to any reform bill this year. One, House members just aren't as determined on the subject; it is the Senate's McClellan Committee that has done the probing on labor racketeering. Too, the House Labor Committee isn't counter-part to the Senate group which avidly puts through liberal labor measures, such as the Kennedy reform bill. This gets all labor measures a quicker start in the Senate.

Another important point: The House members are more attuned to their local constituents. And, despite the drive for a Kennedy reform bill by national labor leaders, such as AFL-CIO chief George Meany, the local officers don't like the reform idea. All the reform proposals contain controls over local officers, as well as national—and the controls aren't appreciated down the line.

MARKETS

UN Lead-Zinc Committee Calls for Export Cuts; Lead Up ½c; Zinc Steady

NON-FERROUS METAL PRICES in April were almost unchanged. The E&MJ index, measuring the six major non-ferrous metal prices, rose to 120.1% of the 1947-'49 average from 119.9 in March. Copper prices were slightly higher and lead was down somewhat.

Action by the UN sponsored Lead-Zinc Committee, composed of Government and industry delegates from 20 countries, is likely. The committee was convened in New York April 28; it had first met early in September in London and next in Geneva in November.

At this writing a draft proposal is being discussed at the full Committee meeting. A subcommittee composed of three exporting countries and two importing countries had been charged with the responsibility of drawing up a report for consideration by the whole Committee. The five countries are Australia, Belgian Congo, Canada, U.S. and U.K. The Committee has not taken final action but it is almost certain it will decide to ask Governments to request producing companies in each country to reduce exports and output. This had been proposed at the meetings in Geneva but largely owing to strong Canadian opposition had not been adopted.

In recognition of the drastic overproduction of lead and zinc, and evidently to encourage world-wide reductions and concerted action through the committee, Asarco a week before the meetings, announced it was cutting output of lead at Mt. Isa by 9,000 tons annual rate and production will be at 53,000 tons; its lead capacity is 79,000. It will also market only half its zinc concentrate production. Its Buchens Mine in Newfoundland will cut lead and zinc output 10% June 1. Consolidated Mining and Smelting of Canada announced it would cut exports to certain markets by about 15,000 tons annual rate of lead and about 20,000 tons of zinc. April 29, the second day of the meetings, the Belgian Congo producer, Katanga, announced it was cutting exports by 5,000 metric tons annual rate; in 1958 it exported 52,000 tons (Henry Blaise, an official of Katanga, is an industry delegate to the UN meetings).

The meetings of the Committee held at Geneva in November appeared to get no results. Many delegates indicated that early in that session the chief delegate of the Canadian group, Dennis Harvey, made a speech in which he vigorously attacked the U.S. import quota action. Some thought this reflected the then current Canadian Government general opposition to U.S. foreign trade policy. The U.S. lead import quotas, though cutting back exports to the U.S. by 40 or 50% for some countries, relative to first half 1958 exports to the U.S., did not reduce Canada in exports to the U.S. at all. Canada was also favored in zinc. Failure to get agreement on asking producing firms to reduce exports and output was attributed mainly to the Canadian position.

The probability of getting at least this kind of action became apparent at the first meeting April 28 when Harvey gave what some delegates called a conciliatory talk.

Success of requests for "voluntary" cut-backs is uncertain. There is a good chance firms in addition to the three mentioned above will announce reductions. 1) But it is most uncertain that they will be sufficient to reduce output to consumption and especially to permit some of the heavy stocks to be cut down. 2) There will likely be some price buoying psychological effect— but this would not be long-lived. 3) Pricing policy has little freedom in these industries outside the U.S.; resolutions to hold prices at some acceptable level can have little value in industries in which a commodity exchange plays such a large part—and the LME is important in lead and zinc selling in Europe and indirectly in the U.S.

G. J. MacMahon, chief of the U.K. delegation was elected chairman of the UN sessions and Fernando Berkemeyer, Peruvian Ambassador to the U.S. was elected vice chairman.

Copper prices in the U.S. averaged a little higher in April than in March but prices elsewhere were a little lower. LME prices eased in the course of the month as buyers and others began to believe heavy production might prevent a copper shortage. Increasing doubt that copper firms would be struck for more than a week or two contributed. Prices also dropped when it was learned the U.S. Government's Office of Civilian and Defense Mobilization was considering releasing some of the copper in the DPA inventory. This copper, estimated at 128,000 tons, was purchased by the General Service Administration in accordance with Government contracts with producers. But apparently the strategic stockpile is filled and also there may be a shortage of funds with which to transfer copper from DPA.

The political furor finally brought a committment from the Administration not to sell. But the commitment does not guarantee that sales will not be made in the more distant future—presumably if there is a strike and copper becomes short it might be sold after the strike is settled. It would probably be politically unwise to sell during a strike.

Copper fabricating activity in the U.S. was almost at record level in March. Shipments of products, sales and unfilled orders mounted. Not all of this, probably only a small part, represented hedge buying by users of products. The upsurge in general business activity (the Federal Reserve Board's index of industrial production reached an all-time high of 147% of the 1947-'49 average and Commerce's data on national income were up) is undoubtedly accompanied by a "real" upward shift in demand for copper products.

Deliveries of refined copper jumped in March and stocks in the U.S. remained at minimum levels. But stocks rose outside the U.S. Total sales of copper submitted to E&MJ for calculating average weighted prices in April were heavy and totaled close to 200,000 tons.

The strike of Asarco's Tacoma refinery continued. The Chino strike of Kennecott was settled. Discussions between union and management at some copper properties were begun in connection with termination of present contracts.

Lead rose in the U.S. to 11½c N.Y. A major custom smelter raised from 11c on April 20. Many were surprised. Immediately before the raise there were two or three days of heavy buying. Part of this buying was by firms that ordinarily use heavy amounts of secondary metal and were unable to get their full quota. Some was by secondary producers who bought primary metal to service their customers. To some extent this apparent scarcity reflected holding of scrap by dealers. Holding of metal by secondary producers was also pertinent. They were intent on keeping metal until the price rose enough for them to sell at an amount compatible with the higher prices they had paid (in some cases as long ago as last fall) for scrap. The belief export and production restrictions would be undertaken was also significant. Lead may go to 12¢.

Zinc sales in April were about equal to March sales and about 20% above February. Prices were steady. Some observers said there were also indications of the seasonal decline in sales of Special High as auto firms moved closer to the model changeover period. Prime western could suffer if steel firms are struck.

Major primary aluminum companies indicated first quarter profits were under those for the first and last quarter of 1958. Price discounting and cessation of stockpiling is probably largely responsible.

Average Prices April *(E&MJ Quotations)*

Copper:

Electrolytic, domestic refinery	31.300
Electrolytic, export refinery	29.397
Electrolytic, c.i.f. Cont'l ports	30.342

Lead:

Common, New York	11.189
Common, St. Louis	10.983

Silver:

Silver, New York, per oz.	91.375
Silver, London, pence per oz.	79.193

Zinc:

Prime, Western, East St. Louis	11.000
Prime, Western, delivered (g)	11.500

Tin:

New York Straits	102.517
Gold, per oz., U. S. price	$35.000
Sterling Exchange	281.653
Quicksilver, per flask	$240.545
Antimony (E&MJ) (d)	32.590
Antimony, bulk, Laredo	29.000
Antimony, in cases, Laredo	29.500
Platinum, refined, per oz.	$77.000
Cadmium (a)	120.000
Cadmium (b)	120.000
Cadmium (c)	120.000
Al., 99½ dom., ingot	26.800
export, pig.	22.500
Magnesium, ingot	35.250
Nickel (f)	74.000

Domestic quotations, unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.

(a) Cadmium average based on the producers' quotations.

(b) Cadmium average based on the average of the producers' and platers' quotations.

(c) Cadmium average based on platers' quotation.

(d) Domestic 5 tons or more but less than carload lots, packed in case f.o.b. New York

(f) Contract price, f.o.b. Port Colborne U.S. duty included.

(g) Delivered where freight exceeds 0.5c.

"Free" Gold Market

April saw a sharp rise of 48% in the volume of International Gold Dealings. Bar prices rose to near highs in India while increasing somewhat in Western Europe. Coins fluctuated within narrow margins. The Soviet sold 65 to 75-million dollars worth of gold in London and Zurich. The largest outflow of gold from the U.S. in 7 months took place, reducing the gold stocks to its lowest level in more than 10 years. Pick's World Currency Report quotes on "free gold" per fine oz as follows:

	COINS		BARS (12.5 kg)	
	Mar. 31	Apr. 30	Mar. 31	Apr. 30
NEW YORK transit	.....	.....	$35.08½	$35.08½
MANILA	$42.00	$42.50	36.15	36.15
HONG KONG	46.60	46.75	38.70	38.95
BOMBAY	64.00	64.50	63.50	64.00
TANGIER	40.75	40.70	35.25	35.25
BEIRUT	41.25	41.05	35.19	35.19
PARIS	40.50	40.10	35.65	35.75
BUENOS AIRES	38.50	38.45	35.80	86.15

Note: Prices are quoted at the free or black market value of the U. S. dollar in the local markets.

Custom Smelter Copper Price

Based on flat price and E&MJ-average price sales in U. S. for month of April reported by American Smelting & Refining Co.: electrolytic copper in standard shapes, adjusted to nearest ⅛c; ¼c deducted for selling common.

Delivered Consumers' plant	31.875 lb
F.o.b. refinery	31.475 lb

Major Metals

U. S. DAILY AND AVERAGE PRICES

Apr. 1959	Electrolytic Copper (a) Domestic	(b) Export	Europe c.i.f. (c)	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis	Aluminum Primary Pig 99½% U. S. Dest.	Straits Tin New York
1	31.425	30.425	31.370	11.000	10.800	11.500	11.000	24.700	102.625
2	31.425	30.450	31.395	11.000	10.800	11.500	11.000	24.700	102.875
3	31.450	30.525	31.470	11.000	10.800	11.500	11.000	24.700	102.875
6	31.625	30.675	31.620	11.000	10.800	11.500	11.000	24.700	103.000
7	31.625	30.400	31.345	11.000	10.800	11.500	11.000	24.700	102.625
8	31.225	30.450	31.395	11.000	10.800	11.500	11.000	24.700	102.500
9	31.400	30.075	31.020	11.000	10.800	11.500	11.000	24.700	102.625
10	31.300	30.025	30.970	11.000	10.800	11.500	11.000	24.700	102.500
13	31.250	29.550	30.495	11.000	10.800	11.500	11.000	24.700	102.250
14	31.275	29.225	30.170	11.000	10.800	11.500	11.000	24.700	102.250
15	31.150	29.175	30.120	11.000	10.800	11.500	11.000	24.700	102.500
16	31.175	28.275	29.220	11.000	10.800	11.500	11.000	24.700	102.250
17	31.200	28.250	29.195	11.000	10.800	11.500	11.000	24.700	102.250
20	31.200	28.550	29.495	11.155	10.820	11.500	11.000	24.700	102.125
21	31.275	28.800	29.745	11.500	11.300	11.500	11.000	24.700	102.250
22	31.225	29.100	30.045	11.500	11.300	11.500	11.000	24.700	102.500
23	31.350	29.050	29.995	11.500	11.300	11.500	11.000	24.700	102.250
24	31.175	28.675	29.620	11.500	11.300	11.500	11.000	24.700	102.375
27	31.175	28.825	29.770	11.500	11.300	11.500	11.000	24.700	102.375
28	31.325	28.850	29.795	11.500	11.300	11.500	11.000	24.700	102.750
29	31.125	28.650	29.595	11.500	11.300	11.500	11.000	24.700	102.875
30	31.225	28.725	29.670	11.500	11.300	11.500	11.000	24.700	102.750
AVERAGES FOR MONTH									
Apr.	31.300	29.397	30.342	11.189	10.983	11.500	11.000	24.700	102.517
AVERAGES FOR WEEK									
Apr.									
1	31.415	30.269	31.214	11.400	11.200	11.500	11.000	24.700	102.656
8	31.470	30.500	31.445	11.000	10.800	11.500	11.000	24.700	102.775
15	31.275	29.610	30.555	11.000	10.800	11.500	11.000	24.700	102.425
22	31.215	28.595	29.540	11.231	11.004	11.500	11.000	24.700	102.275
29	31.230	28.810	29.755	11.500	11.300	11.500	11.000	24.700	102.525
CALENDAR WEEK AVERAGES									
Apr.									
3	31.385	30.444	31.389	11.200	11.000	11.500	11.000	24.700	102.725
10	31.435	30.325	31.270	11.000	10.800	11.500	11.000	24.700	102.650
17	31.210	28.895	29.840	11.000	10.800	11.500	11.000	24.700	102.300
24	31.245	28.835	29.780	11.431	11.204	11.500	11.000	24.700	102.300

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.0400c per pound, the average differential for delivery charges.

(b) Export copper daily quotations are weighted averages based on sales outside the U.S. reported to E&MJ. Ocean freight and 0.125c lighterage and handling are deducted to arrive at the f.o.b. Atlantic seaboard refinery quotation. On f.a.s. U.S. sales lighterage of 0125c is deducted.

(c) The c.i.f. Continental ports quotation is arrived at by adding to the f.o.b. export quotation lighterage, and the standard conference freight and insurance, Atlantic ports to main Continental ports. Currently this is 0.125c and 0.82c.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingots: cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West effective April 9, 1958, commanded a premium of 1c per pound over the current market for Prime Western; Special High Grade 1.25c effective April 9, 1958.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points (almost all U. S. lead is corroding grade).

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Apr. 1959	Silver (c) New York	Silver London	Sterling Exchange	Gold (d) London
1	91.375	79.375d.	281.6300	249s. 1½d.
2	91.375	79.375d.	281.6250	249s. 1¼d.
3	91.375	79.375d.	281.6600	248s. 11⅝d.
6	91.375	79.375d.	281.6200	249s. 1½d.
7	91.375	79.375d.	281.5400	249s. 2¼d.
8	91.375	79.375d.	281.6600	249s. 3¼d.
9	91.375	79.125d.	281.6200	249s. 2¼d.
10	91.375	79.125d.	281.6300	249s. 1¾d.
13	91.375	79.125d.	281.7000	249s. 1½d.
14	91.375	79.125d.	281.7300	249s. ¾d.
15	91.375	79.125d.	281.7400	249s. 1d.
16	91.375	79.125d.	281.7200	249s. 1¼d.
17	91.375	79.125d.	281.7100	249s. 1¾d.
20	91.375	79.125d.	281.7400	249s. 2d.
21	91.375	79.125d.	281.7600	249s. 1½d.
22	91.375	79.125d.	281.7200	249s. ½d.
23	91.375	79.125d.	281.6220	249s. 1d.
24	91.375	79.125d.	281.5400	249s. 2¼d.
27	91.375	79.125d.	281.6500	249s. 2¼d.
28	91.375	79.125d.	281.6600	249s. 2d.
29	91.375	79.125d.	281.5700	249s. 2d.
30	91.375	79.125d.	281.5800	249s. 3½d.
AVERAGES FOR MONTH				
Apr.	91.375	79.193d.	281.653	—
AVERAGES FOR WEEK				
Apr.				
1	91.375	—	281.554	—
8	91.375	—	281.609	—
15	91.375	—	281.684	—
22	91.375	—	281.730	—
29	91.375	—	281.608	—

Calendar Week Averages: New York Silver: Apr. 3, 91.375; Apr. 10, 91.375; Apr. 17, 91.375; Apr. 24, 91.375.

(e) No Market (Saturday).

(c) The daily silver quotations reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harmn in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harmn for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price is $35. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS *(Continued)*

London Metal Exchange Quotations

Apr.	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
1	249	249¼	248¾	249	67¼	67⅜	68¼	68⅜	72½	72⅝	72⅝	72½	780	781	782½	783
2	250¼	250½	250¼	250½	67⅞	68	69¼	69½	71	71¼	71	71¼	782	782½	784½	785
3	249¾	250	249½	249¾	68⅛	68½	70	70⅛	71⅜	71½	71⅜	71½	782	782½	784½	785
6	250½	251	250½	250¾	69¼	69⅜	70¼	70⅝	72	72⅛	71⅞	72	782	782½	785	785½
7	247¼	247¾	247¼	247½	68¾	69	69¾	69⅞	71½	71⅝	71¼	71½	781½	782	784½	785
8	247½	248	247½	248	69¼	69½	70⅛	70¼	71⅜	72	71⅞	72	782½	783	785	785½
9	244½	244¾	244½	244¾	68⅝	68¾	69⅜	69¾	71⅝	71⅝	71¼	71⅝	782	782½	784½	785
10	242½	242¾	242½	242¾	68⅛	68¼	69⅜	69½	71½	71⅝	71¼	71⅜	780	780½	782½	783
13	239¼	239½	239¼	239½	67⅞	68	69⅛	69½	71⅝	71⅞	71¼	71⅝	778	779	779	781
14	238	238¼	238	238¼	68⅜	68½	69¾	70	71⅝	71¾	71¼	71½	780	780½	782	782½
15	236¾	237	236¾	237	67¾	68	69½	69¾	71½	71⅝	71⅜	71½	782½	783	783½	784
16	229½	229¾	229¾	230	67½	68	69½	69¾	71½	71⅝	71⅜	71½	781	782	782	783
17	234¼	234¾	234½	±35	68¼	68⅝	69⅜	69⅞	72	72¼	71⅞	72	782	782½	783	784
20	233¾	234	234¾	234½	69¼	69½	70⅞	71	73	73⅛	72⅝	73	783½	784	784½	785
21	236½	236¾	237¼	237½	69¾	69⅞	71¼	71½	73½	73¾	73¼	73⅝	783½	784	784½	785
22	238¾	239	239¼	239½	69¾	70	71¼	71⅝	74	74¼	73¾	73⅞	783½	784	784	784½
23	235¼	236	236½	236¾	70¼	70⅜	71¾	72	73⅞	74	73½	73⅝	782	783	783	783½
24	234	234¼	234¾	235	70⅜	70½	71⅞	72	74¼	74⅜	74	74¼	781½	782	782	782½
27	235¾	236	236½	236¾	70⅝	70¾	72	72½	75	75¼	74½	74¾	783½	784½	784	784½
28	235¾	236	236¾	237	70½	70⅝	71⅞	72	74¼	74½	73¾	74	783½	784	784	784½
29	233¼	233¾	234¼	234¾	70	70¼	71½	71¾	73⅞	74	73¾	73⅞	783	783½	783½	784½
30	234½	234¾	235¼	235¾	69¾	69½	70½	70⅝	74½	74¼	73¾	73¼	783½	784	784	784½
Av'g's	£240.017	£240.324			£69.048		£70.418		£72.688		£72.460		£782.261		£783.773	

Prices are for the official a.m. session in pounds sterling per ton of 2240 lb. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments, f.o.b. New York unless otherwise stated, tons of 2,000 lb. unless otherwise noted. St—short ton; lt—long ton. (p) duty paid.

MISCELLANEOUS METALS

Apr. 30, 1959

Aluminum ingot, 99 plus % lb.			26.8¢
Antimony, spot, lb., less than carload, in cases			32.59¢
In bulk, carload lots, f.o.b. Laredo			29.00¢
Imported, 10 ton min. (p), 99½%			24¢
Bismuth, ton lots, lb.			$2.25
Cadmium, commercial sticks, delivered, lb.			$1.20
Calcium, lb., ton lots, 98%, cast			$2.05
Chromium, 97% grade, lb., contract del.			$1.29
Cobalt, 97 to 99%, per lb. eff. Feb. 1, 1957			$1.75
Germanium, per gram, 10,000 gram lots	(d) 33¢	@(c)(d)	35¢
Indium, troy oz.	$1.25	@	$2.25
Lithium, lb., 98%	$9.00	@	$11.00
Nickel, cathodes, lb. (a)			74¢
Other sales, reg. sellers			74¢
Sales by dealers, etc.			74¢
Magnesium, 99.8% carloads, lb. producer's plants, Velasco, Texas eff. Apr. 16			35¼¢
Palladium, troy oz.	$18.00	@	$20.00
Platinum (wholesale lots), troy oz.	$75	@	$80
Quicksilver flask of 76 lb. 25 flasks or more	$245	@	$249
Selenium, 99 plus %, lb.—(Feb. 19, 1958)			$7.00
Silicon, minimum 97%, carloads, lb.			21½¢
Semi Conductor grade, lb.			$350
Tellurium, lb.			$2
Thallium, 100 lb. or more lb.			$7.50
Titanium, 99.3 plus, grade A-1, max. 3% iron, lb. (b)	$1.62	@	$1.82

(a) Eff. Dec. 6, 1956; incl. U. S. duty; (b) Effective Oct. 1, 1958. (c) Delivered; (d) f.o.b. plant.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, (b) stu: spot			$30
term contracts	$31	—	$32.25
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$19	@	$20
48% Cr_2O_3 3 to 1 ratio	$40	@	$46
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$11.85(e)
Mesabi bessemer			$11.60(e)
Mesabi non bessemer			$11.45(e)
Lead (Galena), 80%, Joplin, Mo., ton			$134.52
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties, c.i.f. U. S. ports import duty extra, 87¢—90¢. Long-term contract nominal. Indian Gov't export duty discontinued Nov. 24, 1958.			
Molybdenum Ore, 90%, per lb. of Mo f.o.b. mines			$1.25
Columbium-Tantalum, per lb., combined oxides 10 to 1 ratio	$1.10	@	$1.15
Tungsten Ore, per stu of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra			$10.75–11.25
U. S. scheelite, f.o.b. mill	$19	@	(a)$22
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton.			$64

(a) Nominal. (b) c.i.f. U. S. ports. (e) Eff. 1958 shipping season.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb., in bbl. carload lots delivered			5¼¢
Cobalt Oxide, 72½% to 73½%, per lb. eff. Dec. 1, '56.	$1.33	@	$1.36
Copper Sulphate, 100 lb. eff. Oct. 24, '58			$12.30
Germanium Dioxide, gm.			18½¢
Molybdic trioxide, technical, per lb. of Mo	$1.46	@	$1.47
Imported, incl. 37¢ duty	$1.75	@	$2.05

ALLOYS

Ferrochrome 65 to 70%, per lb. of Cr, (4-9% C)			28¾¢
Ferromanganese, 74 to 76%, per lb., shipg. pt.			12¾¢
Ferromolybdenum, 58 to 64% Mo lb. of Mo contained	$1.50	@	$1.82
Ferrosilicon, 50% per lb. of Si f.o.b. shipping point (3-1957)			14.60¢
Ferrotungsten, 72 to 82%, lb. of W contained			$2.15
Ferrovanadium, per lb. of V delivered	$3.20	@	$3.40
Silicomanganese, max. 1½% carbon, lb. contracts			12.8¢
Spiegeleisen, per long ton, 10 @ 21% grade eff. Jan. 7			$102.50

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (Canadian funds) ton:			
Crude No. 1	$1,400	@	$1,810
Crude No. 2	$750	@	$1,155
Spinning fibers	$370	@	$600
Shingle fibers	$180	@	$220
Paper stock	$120	@	$145
Waste	$75	@	$86
Shorts	$40	@	$75
Asbestos, f.o.b., Vancouver, B. C. (Canadian funds):			
Crude No. 1			$1,522
Spinning fibers	$220	@	$787
Asbestos, Vermont, f.o.b. Morrisville:			
Spinning fibers	$370	@	$428
Shingle stock	$181	@	$200
Paper stock	$120	@	$152
Waste, stucco or plaster			$86
Refuse or Shorts	$41	@	$75
Barytes f.o.b. cars:			
Georgia, crude, per ton			$18
Missouri, 94%, BaSO, per short ton	$16	@	$18
Crude oil well grade, min. 4.3% sp. gravity, st (a)			$18
Imported, c.i.f. Gulf Ports, st	$16	@	$18
Bauxite, long ton, f.o.b. point of shipment:			
Domestic, crude, 50 to 52% (not dried)	(c)$ 5.00	@	$5.50
Domestic, chemical, 55 to 58%	(c)$ 8.00	@	$8.50
Domestic, abrasive, 80 to 84%	(c)$18.00	@	$18.50
Imported metallurgical, per lt. f.o.b. Br. Guiana, dep. on grade			$7.14
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade			$20.50–$21
Glass feldspar, white, 20 mesh			$9
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$37	@	$41
60% effective CaF_2	$33	@	$36.50
Acid 97% concentrate, bulk, ton (eff. 12–1–56)			$50.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$46

Mica—Domestic, f.o.b. mines. Punch 7¢ to 12¢ per lb. according to size and quality. Sheet clear 1½ x 2-inch, 70¢ to $1.10; x 2 2-inch, $1.10 to $1.60; 2 x 3-inch, $1.60 @ $2.10; 3 x 3-inch, $1.80 @ $2.30; 3 x 4-inch, $2.00 @ $2.60; 3 x 5-inch, $2.60 @ $3.00; 4 x 6-inch, $2.75 @ $4.00; 6 x 8-inch, $4.00 @ $8.00. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground; $30 @ $55 per ton. Scrap $20 @ $30.

Ocher, Georgia, ton in sacks	$26.50	@	$32.00
Purites, Spanish, per long ton unit of S. c.i.f. atlantic ports			Not quoted
Sulphur, per lt. f.o.b. U. S. mines: bright			$23.50
dark			$22.50
Mexican, for use in Mexico, per metric ton, f.o.b. mines, 280 to 395 pesos, depending on use	$22.40	@	$31.60
For export f.o.b. vessel, lt. dep. on grade	$22	@	$24
Talc, f.o.b. works, ton:			
New York, purified	$18.00	@	$20.00
Vermont, extra fine			$12.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$50.00

(a) Some restricted sales at $11.50, (b) Corrected. (c) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces			$66.00
Steel, f.o.b. Pittsburgh, billets, net ton			$80.00
Structural shapes, Pa., Ala., etc. 100 lb.	$5.30	@	$5.50

Can ONE tractor keep up with your scattered maintenance assignments?

Tournatractor with Angledozer® blade uses its 17 mph speed and rubber-tired mobility to handle wide variety of assignments at a large open-pit copper mine in Arizona.

To meet stepped-up production demands, it will pay you to consider a mobile, rubber-tired tractor — one that can efficiently and economically handle your increased clean-up work over larger pit areas. You can save time and money with a mobile tractor-on-rubber that can speed directly to each new assignment, on or off haul roads.

LeTourneau-Westinghouse Tournatractor® — with its wide, low-pressure tires that let you travel anywhere over haul roads, rocky pit floors, RR tracks, ties, switches, and air-drill hose lines — has these capabilities.

Work-and-run mobility

Since this 17 mph tractor can travel 2 to 3 times faster than a crawler, it gives you a major speed advantage when traveling between clean-up assignments around scattered shovels. Tournatractor's speed also increases its versatility, so that it can be used as a multi-purpose tool, to economically handle many types of assignments.

You can use Tournatractor to clean around 2 or more shovels... to maintain stockpiles, level waste dumps, clean debris off RR tracks... to clean benches, handle shallow stripping, switch cars... to pull air-compressors, supply and service wagons on sleds. With this rubber-tired tractor, there are no delays for crawling travel, or for load-and-haul to new location. You can even use it for maintenance and clean-up in one or more adjoining pits.

Many owners report the costs of maintaining Tournatractors to be only *one-fourth* to *one-half* the cost of crawler maintenance. Main reason is that you have only 4 wheels and tires to maintain and replace — instead of the more than 500 moving, wearing track parts on a crawler. Tires flex over rocky floors — do not concentrate loads that break track links. Also, this rubber-tired tractor has less lube points, to cut daily lubrication time to less than one-half that required for a crawler-tractor.

Ask for a demonstration on your job

When analyzing your equipment needs, look into Tournatractor's exceptional work-and-run ability for clean-up work in your pits. Let us give you more information, or ask for a demonstration in your pit, and see what this rubber-tired tractor can do!

Fast clean-up of big chunk rock around shovel is handled by Tournatractor for the Ruberoid Co., near Lowell, Vermont. Tractor dozes at about 8.3 mph, and reverses at 7.2 mph.

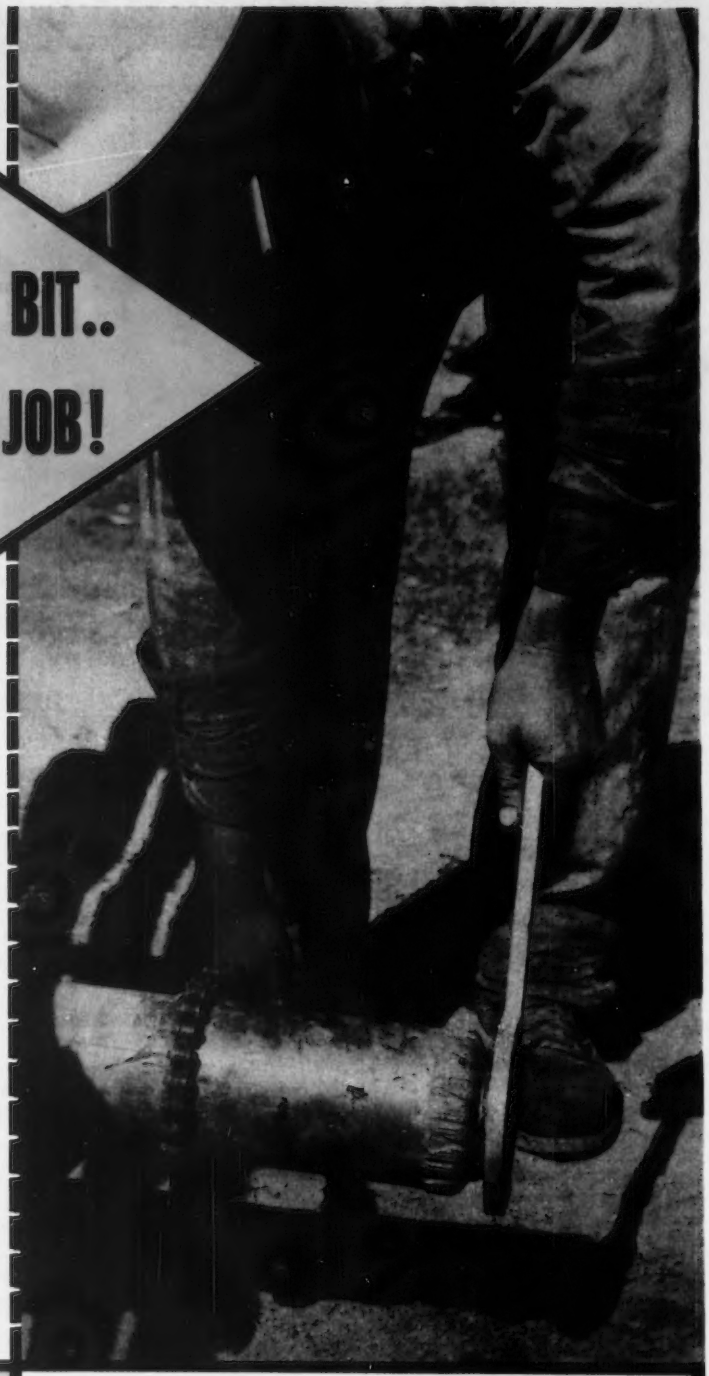
Equipped with type "E" railroad coupler, versatile Tournatractor here serves as a Switch-Tractor*... spots rail cars when not working on dozing chores for southern uranium mine. SwitchTractor can move 5 loaded or 18 empty cars up a 1% grade. *Trademark CT-1727-M-1

LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

THE RIGHT BIT.. FOR YOUR JOB!



And it's there ON TIME!

With plants located throughout the world, Christensen meets your drilling requirements with the right bit, on the job, in time —

RESETTING — Your used diamonds can be reset in the same bit style or type. Your bit style can be changed to meet any new drilling requirement. You are billed only for the new diamonds, plus a nominal fee for setting. Regardless of type or manufacture of core barrel presently in use, we can complete your order of diamond bits or shells to fit its specifications.

TIME — Your new style or reset bit can be shipped within five working days after your order has been received.

CORE BARRELS — For standard equipment listed in our catalog SD 507, a maximum of two days is required before shipment, and frequently shipment is made the same day your order is received. Custom designed core barrels manufactured to any size and specification — let us quote you price and delivery.

MISCELLANEOUS DRILLING SUPPLIES — As a convenience to our customers, drill rod, casing, handling and fishing tools are also available.

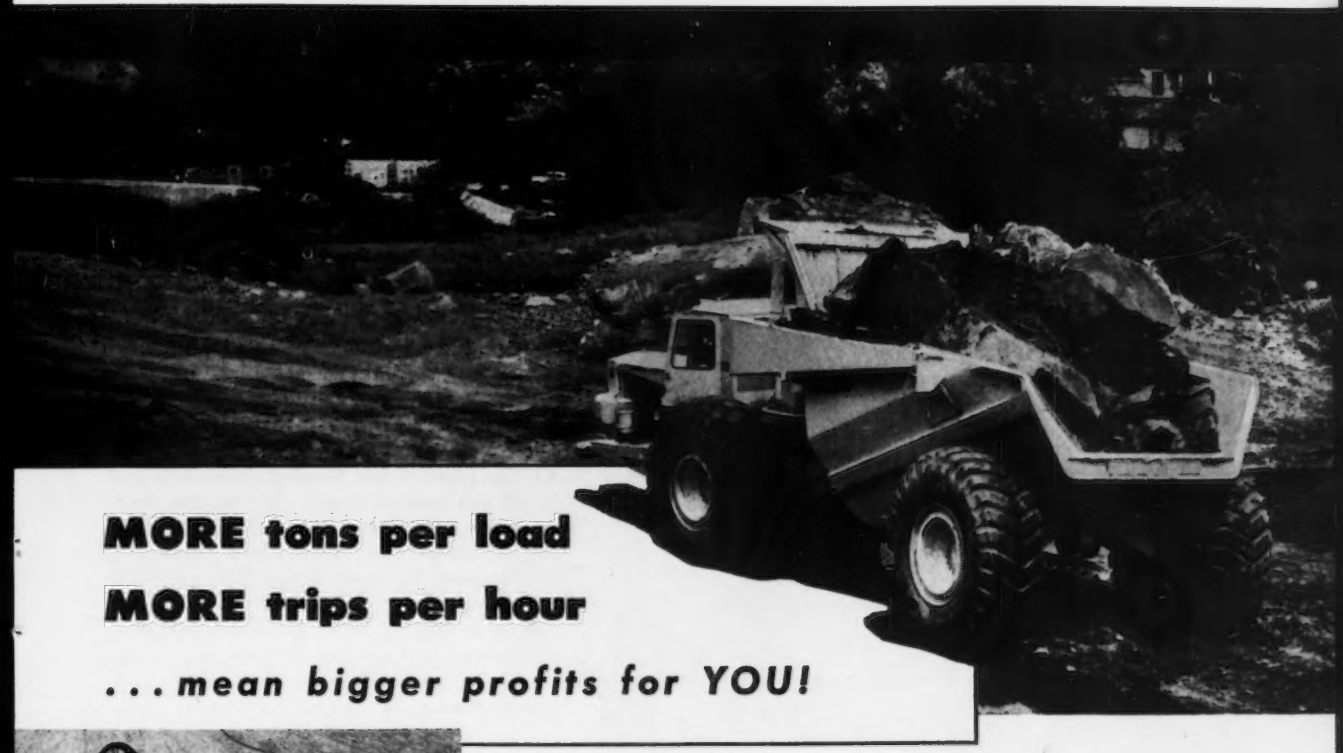
The combination of Christensen's experience and unequaled service assures you of "less cost per foot", regardless of job location.

Call Christensen today!

Diamonds Mean, "Less cost per foot."

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH



MORE tons per load
MORE trips per hour
...mean bigger profits for YOU!

Low rear-entry and wide bowl provide easy target for shovel operator... make for fast swing-out of dipper, let operator heap maximum yardage *fast*, with minimum spillage.

At touch of electric dashboard switch, body lifts, swings low behind rear wheels... dumps clean over bank's edge. On soft fills, Rear-Dump can pull out without wheel-spin. Operator "walks" unit free with electric kingpin-steer ...or "humps" it out by varying wheel-base through use of electric hoist-motor and alternate use of front and rear wheel brakes.

The 35-ton (28-yd.) LeTourneau-Westinghouse B Tournapull® Rear-Dump lets you load and haul *big* loads anywhere. And with speeds to 34 mph, this high-production, off-road hauler delivers more material per shift! Here's why:

Greater maneuverability

Big "B" makes continuous 180° turn in space only 35′ wide... in dump position, in just 27′. This unusual maneuverability lets you work in restricted quarters where conventional haulers often cannot go. You spot quicker at the shovel, dump faster, move more loads per day.

In addition, big *load-rated* tires let Rear-Dumps always take the shortest route — over pavement, rocky pit-floors, rough haul-roads, RR tracks, cross-country, or through muck and over soft fills. Time saved adds up to extra trips per shift.

Fast, easy loading

B Rear-Dump's large target (15′4″ long, 10′2″ wide) permits fast, easy loading without spillage. Open rear of body permits quick bucket swing-out, while dipper door is still open. Because it minimizes loading time, big 35-ton Tournapull Rear-Dump gets more loads per hour, earns bigger profits per day.

Dumps fast, clean

Flick of dashboard switch instantly activates point-of-action electric hoist-motor. Body raises quickly to desired angle. At full dump position, trailing edge of bowl is low behind rear wheels... so material cannot roll forward to lodge against wheels, nor pile under rear end. Streamlined body sheds stickiest material readily.

Safe, positive control with big brakes, electrotarder

Multi-disc air brakes on all 4 wheels provide 7,488 sq. in. of braking surface — permit quick, safe control with heaped load, on any grade, in any weather. Electrotarder gives additional *non-wearing* braking action, through resistance on generator. Parking brake, and automatic emergency braking system, are standard.

Interchangeable work units

Behind same basic prime-mover, the new faster-loading 28-yd. Fullpak® scraper, or 30-ton Crane, can be readily interchanged. For a small additional investment, these trailing units can help keep your Tournapull prime-mover profitably busy the year-around. Choice of 335 hp Cummins or GM engines. Ask for complete details.

BR-1534-G-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

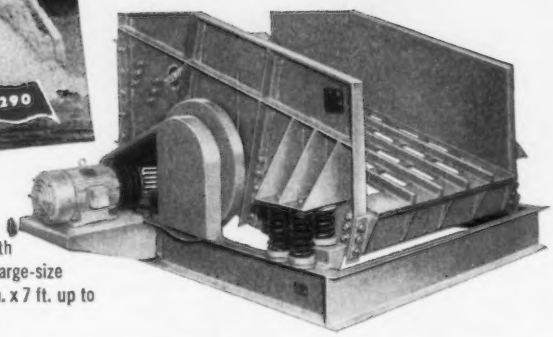
A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

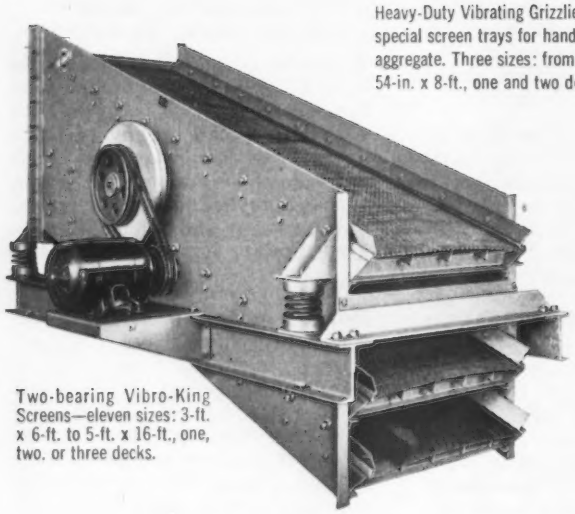
HOW TO PICK SCREENS *that pay profits*

Screening aggregates is a tough job—but it can be done efficiently and at low cost—with Telsmith Vibrating Screens. This new Telsmith bulletin tells you how. It explains which type of screen is best for scalping . . . sizing . . . washing—and why Telsmith builds two types of four bearing screens and one type of two bearing screen. It describes each type; shows several new Telsmith Vibro-King features, including—new counterweight mechanism and new spring suspension, making it the smoothest and most efficient screen you can buy, either for scalping or finishing. Shows new heavy-duty tray construction; best methods for mounting screen cloth. Full of helpful pictures, diagrams and specifications.

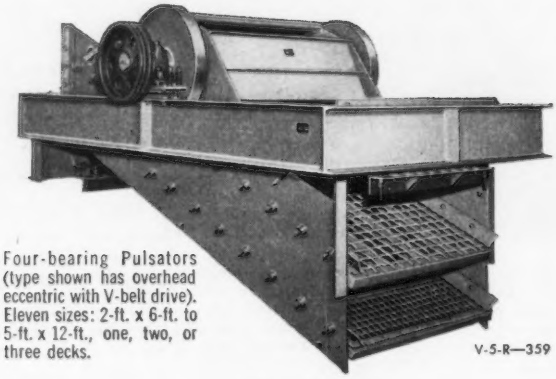
Get this NEW BOOK FREE—Ask for No. 290



Heavy-Duty Vibrating Grizzlies, with special screen trays for handling large-size aggregate. Three sizes: from 45-in. x 7 ft. up to 54-in. x 8-ft., one and two decks.



Two-bearing Vibro-King Screens—eleven sizes: 3-ft. x 6-ft. to 5-ft. x 16-ft., one, two, or three decks.



Four-bearing Pulsators (type shown has overhead eccentric with V-belt drive). Eleven sizes: 2-ft. x 6-ft. to 5-ft. x 12-ft., one, two, or three decks.

V-5-R—359

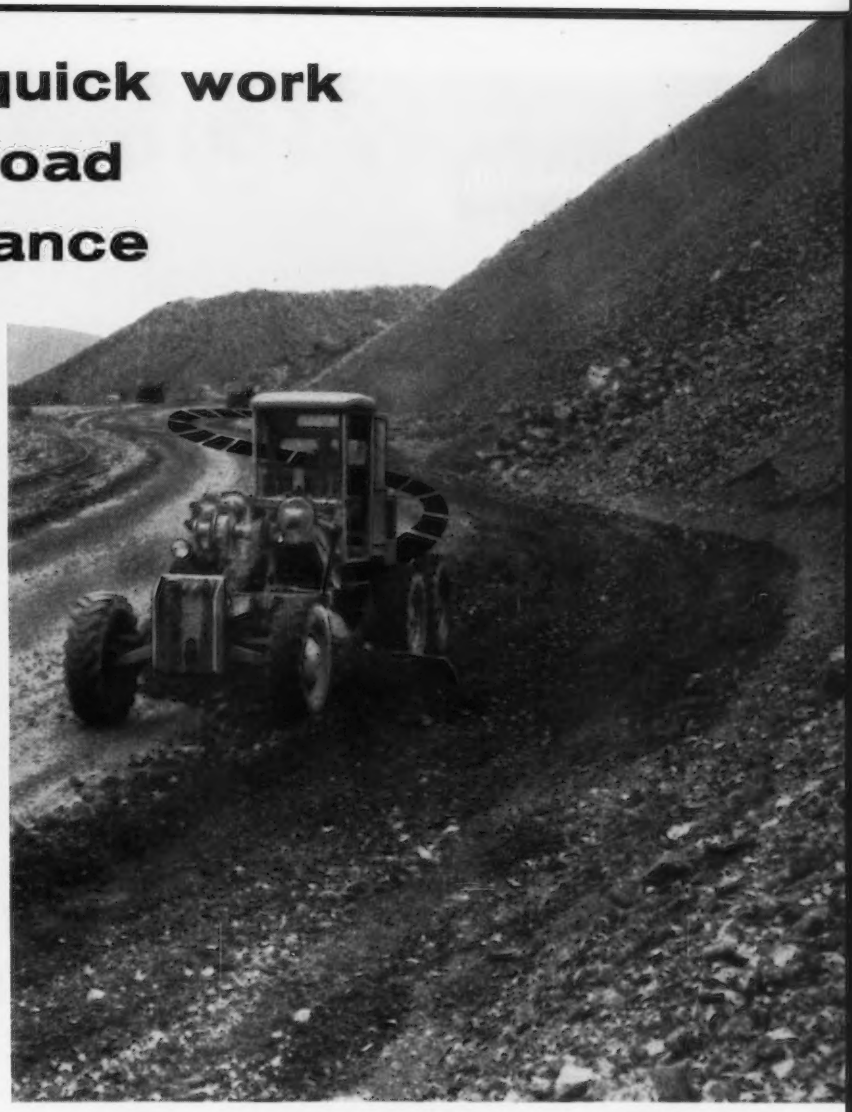
SMITH ENGINEERING WORKS

502 E. CAPITOL DRIVE **MILWAUKEE 1, WISCONSIN**

Representatives in Principal Cities in All Parts of the World • **Cable Address: Sengworks, Milwaukee**

Where quality is a habit

Makes quick work of haul-road maintenance



Powerful L-W Adams 660 — at large open-pit mine in Arizona — patrols busy haul roads 24 hr a day, 6 days a week. Grader goes wherever needed (at speeds to 26 mph) to fill ruts, level washboard, clear debris dropped by overloaded haulers and improve drainage.

You know from experience that using the *right* tool on any job completes the work faster and easier. The same holds true when maintaining your haul roads, pit floor, dump areas around crusher, and stockpiles, or waste dump. Use a heavy-duty L-W Adams† grader for these maintenance assignments. You'll find you can complete this work *faster* and *at lower cost.*

Greater work range

All LeTourneau-Westinghouse 80, 115, 123, and 160 hp Adams graders have constant-mesh transmission as standard, with 8 forward and 4 reverse speeds. In addition, 3 optional creeper speeds provide extra lugging power for turning up rocky subsurfaces and for greater grading accuracy. Choice of 15 gear ratios give you the balance of power and speed to handle every grading job . . . in any material . . . at top efficiency.

Smooth, accurate control

Adams' blade mechanism is firmly mounted on a heavy-duty circle for chatter-free operation. Strong T-shaped drawbar gives L-W grader firm circle support for accurate blading in any material.

Blade positioning is fast . . . it swings maximum arc from deep ditch-cut to high bank-cut in less than a minute. Moldboard turns 360° — clockwise or counter clockwise — provides quick change from any forward work position, to desired angle for reverse ditching and grading.

Low operating costs

All gears operate on anti-friction bearings — for less wear, easier operation. Automatic braking on transmission, when hydraulic brakes are applied to wheels, gives safer operation and less maintenance. And because L-W power-control clutches shift on ball bearings, you have easier, smoother, safer controls . . . assuring accuracy, speed, and performance with minimum upkeep.

Keeps busy all year

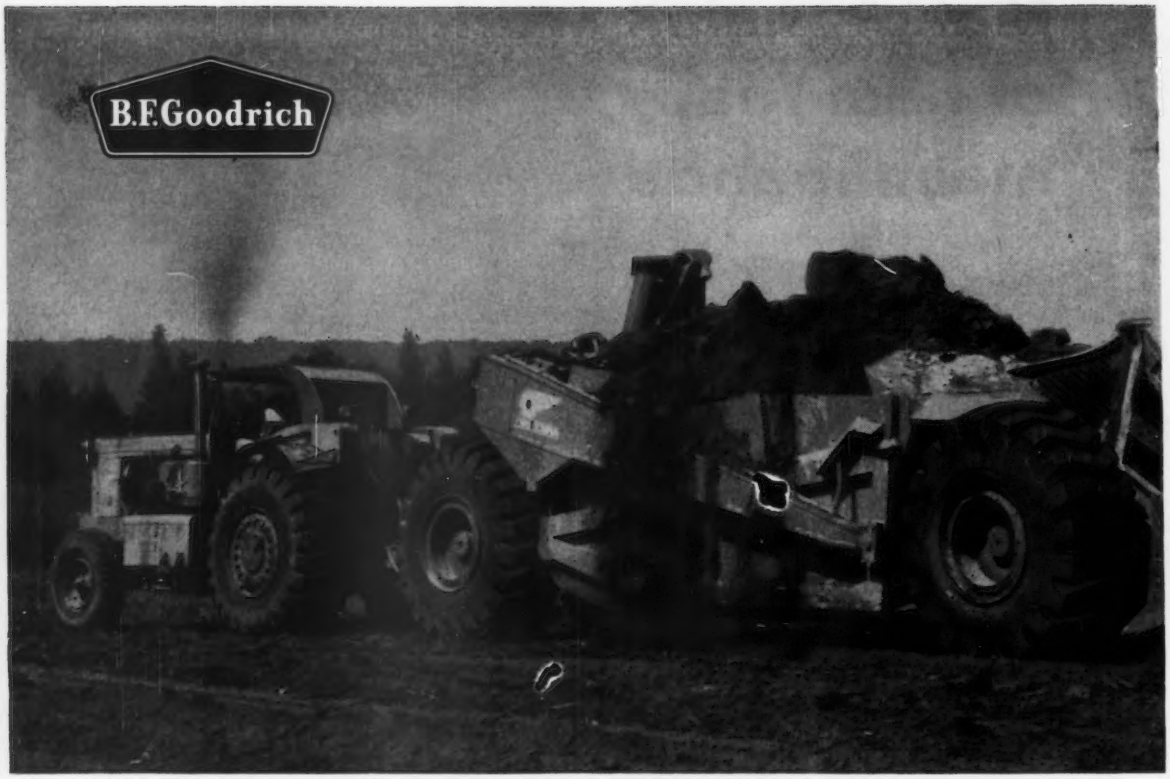
Between regular assignments, your LeTourneau-Westinghouse grader need not sit idle. With available attachments, such as Jebco Elegrader, bulldozer blade, scarifier, snow plow and wing, you can keep this grader busy on your property the year round. Also, grader's high travel speeds (to 26 mph) permit the profitable handling of jobs for adjoining pits. There are 7 Adams models — 60 to 190 hp. Your choice of GM or Cummins engines on 6 larger models. 190 and 135-hp POWER-*Flow*® models have torque-converter drive . . . will do more work faster than any other graders on the market. Call or write for a demonstration today!

†Trademark G-1874-MQ-1

LeTOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit



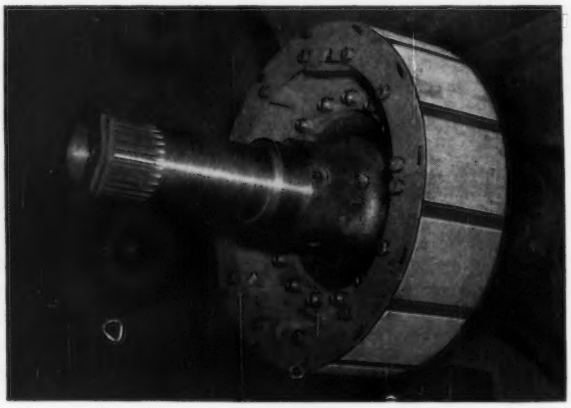
World's biggest scraper units need... and use... B. F. Goodrich Hi-Torque brakes

WEISS DAM, ALABAMA—A struck capacity of 40 cu. yds. makes the M-R-S Model 250-HW tractor-scraper the world's largest hydraulic tractor-scraper combination. And with powerful 600-h.p. engines pushing them to speeds of 34 miles an hour, these units need the finest stopping power available.

That's why M-R-S uses new B.F.Goodrich Hi-Torque Brakes. Now at work on the Weiss Dam Project, M-R-S scrapers move heaping loads at high speeds along a ¾ mile haul. And they make each round trip with complete safety, because B. F. Goodrich Hi-Torque Brakes stop *twice as fast* as conventional brakes, with less chance of brake fade.

Exclusive "full-circle" stopping power provides more uniform lining pressure than any other off-road drum brake. In addition, B.F.Goodrich Hi-Torque Brakes have an automatic adjusting feature which eliminates maintenance throughout lining life. Lining changes can be made with standard hand tools, and no lubrication is necessary.

B. F. Goodrich Hi-Torque Brakes on the M-R-S 250-HW tractor-scrapers enable operators to control the placement and depth of spreads, even on steep grades. So next time you buy tractor-scrapers, dump trucks or any other wheeled off-road vehicles, remember that B.F.Goodrich Hi-Torque Brakes reduce cycle time – provide greater safety – cut expensive maintenance. Ask your equipment manufacturer for details, or write: *B.F.Goodrich Aviation Products, a division of The B. F.Goodrich Company, Dept. EM-59, Troy, Ohio.*



B.F.Goodrich *Hi-Torque brakes*

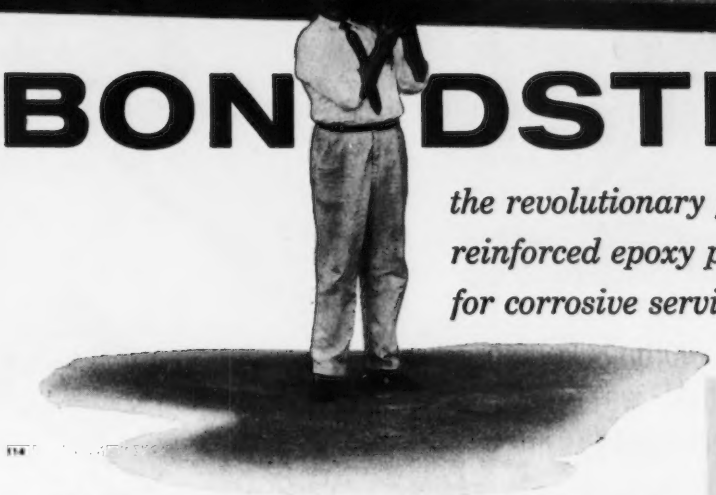
STRONG as steel pipe

... at one-eighth the weight!

Circumferential Tensile Strength ... 80,000 psi

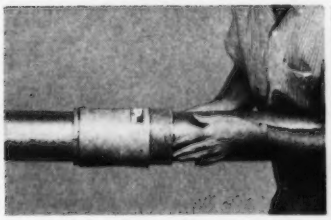
BONDSTRAND®

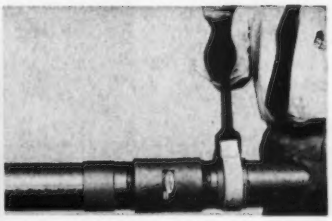
the revolutionary fiber glass reinforced epoxy pipe for corrosive service



Here's a pipe that holds up indefinitely under the corrosive action of many salt, acid and alkaline solutions ... that can't contaminate or flavor the piped material ... that is rigid enough to resist sag, cold flow or deformation – flexible enough to follow normal ditch contours ... that remains smooth and unclogged throughout its entire service life ... that won't leak, even near its burst pressure.

Easy to install, with choice of locking wedge or threaded fittings.





Simple instructions with each shipment insure a perfect joint on the first try.

IN THE MINING INDUSTRY...

Because BONDSTRAND pipe is light in weight, nonconductive, nonsparkling and corrosion resistant inside and out, it is ideally suited for mining operations. It is suggested for lines carrying fresh water, mine water and compressed air; and for air ducts, especially where oxidized sulfides are involved. Other uses include transport lines in plants which chemically treat ore, and pumping lines between leaching tanks, clarifiers, precipitation tanks and similar equipment.

Amercoat® CORPORATION

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A Subsidiary of American Pipe & Construction Company

Thinking about bolting your roof? Remember that we offer more than proved bolts and accessories. Bethlehem contact men are available at all times to assist in installation and testing. Just call or write our nearest sales office. We'll do the rest.

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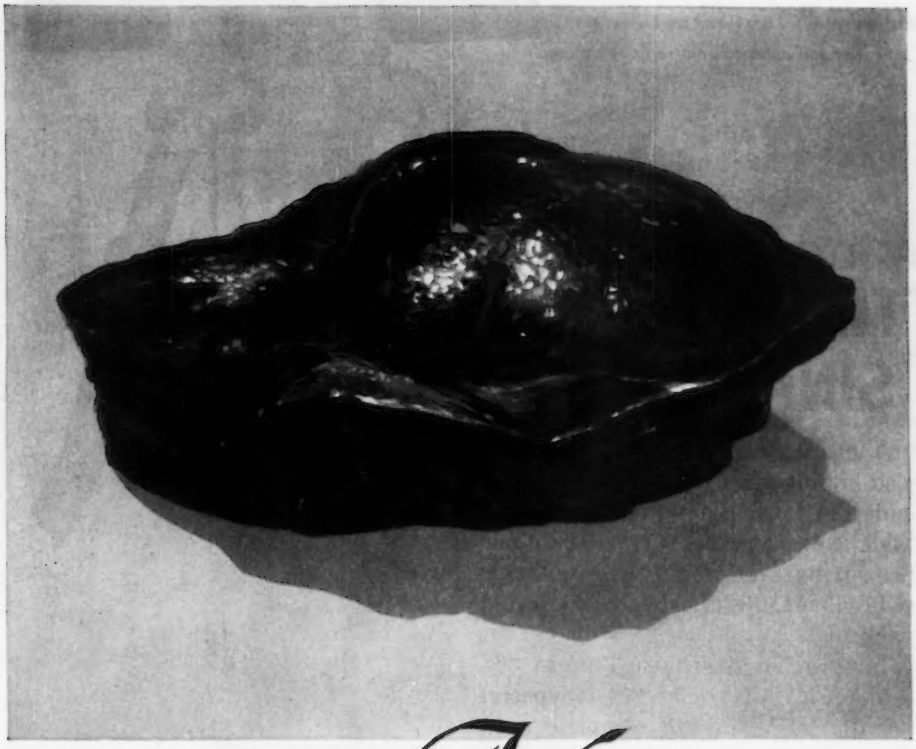

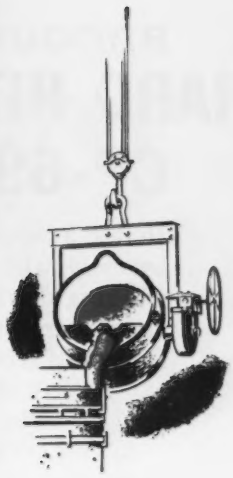

Hematite

Fe_2O_3

...life blood of Industry

Derived from the Greek word meaning blood, or blood-like, Hematite was so named because of the reddish hue found in most of its varieties. This important mineral has indeed provided "life blood" for the iron and steel sinews of industry. For many decades, Hematite—the basic ingredient which feeds the blast furnaces of the world—has been one of the most important minerals of civilization.

Symons Cone Crushers, with their great capacity for finely crushed material at low cost, have been an important factor in the efficient reduction of the Hematite, as well as the Magnetite and Taconite iron ores throughout the world, and have established outstanding production records in keeping pace with industry's insatiable demands.

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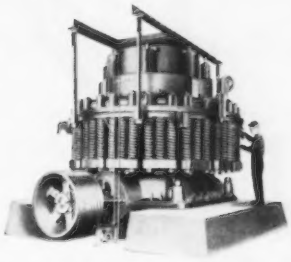

SYMONS CONE CRUSHERS

. . . The machines that revolutionized crushing practice . . . **are built in a wide range of sizes, for capacities to over 900 tons per hour. Write for descriptive literature.**

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NORDBERG MACHINERY

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SYMONS . . . a registered Nordberg trademark known throughout the world.

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New CP-69 Sinker has universal backhead for blower-dry, wet and automatic air-water operations.

announcing the **NEW**

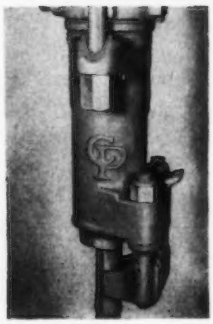
HARD HITTING CP-69 SINKER DRILL

Here's a 55-pound class sinker, exceptionally well balanced, with good hitting power to make it a hard-working down-hole drill *and* a fine performer on airleg work as well. New type beaver tail retainer eliminates retainer springs—improves steel retention and reduces steel breakage. Retainer can be rotated 180° for airleg work.

Airlegs, either integral or attachable type in 36″ or 48″ standard feed and a 72″ telescopic leg for special requirements is available. Write for complete data on the new CP-69 Sinker.

Integral telescopic airleg for CP-69 Sinker

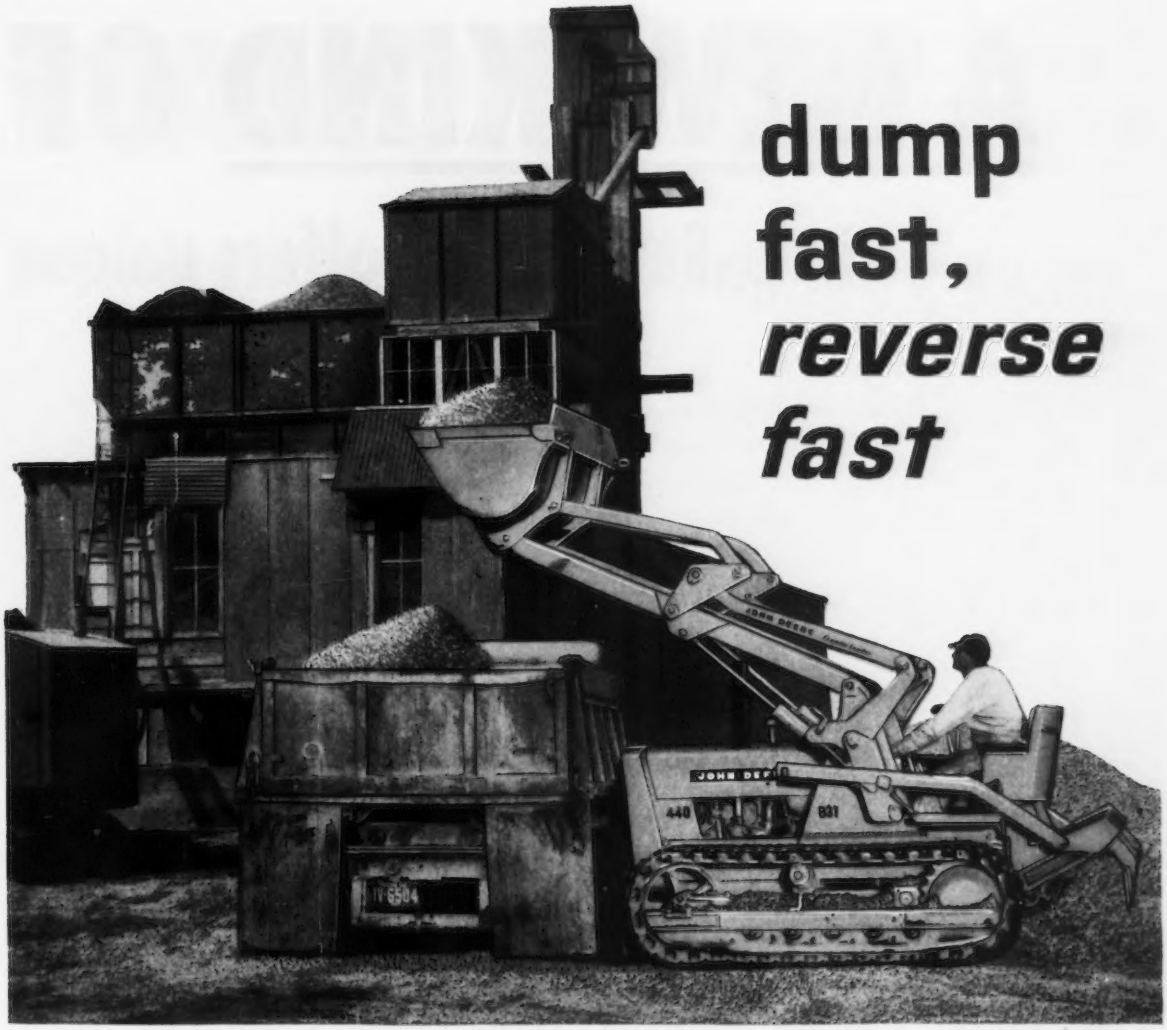
Attachable telescopic airleg for CP-69 Sinker



Close-up shows Beaver Tail Retainer with latch closed

Chicago Pneumatic *8 East 44th Street, New York 17, N. Y.*

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AIR BLAST BITS



Faster Moves Mean More Tons Per Hour with the JOHN DEERE CRAWLER-LOADER

Basic Facts on the 831 Loader

Bucket Capacity	7/8 Yard, Heaped
Rollback	35 Degrees
Pry-out Pressure	8500 Pounds
Dumping Clearance	7 Feet, 10 Inches
Dumping Angle at Full Height	50 Degrees
Engine Options	Gasoline or Diesel

HERE'S why you get that short cycle time and handling ease with a John Deere Crawler-Loader. The bucket roll-back linkage lets the operator dump bucket from full-height position and return it to the ideal digging angle by use of the boom-control only. And there's no need to shift gears to back away from the truck or hopper and head for the stockpile—the clutch-type direction reverser takes care of that.

Both Diesel and gasoline units are available, each with a new heavy-duty transmission and new working speeds to give you most efficient use of this low-cost power.

See your John Deere Industrial dealer for a demonstration—discover for yourself why this loader gives you top work-capacity per dollar.

More facts? Write John Deere Industrial Division, Dept. 541, Moline, Ill.

JOHN DEERE *"Specialists in Low-Cost Power with a Heavyweight Punch"*

A NEW KIND OF

"Circle-Set" design offers unique

Diamond Core Drill Manufacturers • Core Drilling Contractors

DIAMOND BIT from Longyear

combination of core drilling advantages

The new Circle-Set bit—developed by Longyear—is designed with diamonds set in concentric ridges. These rings cut V-shaped grooves in the rock. Pressure of the diamonds against the sides of these grooves breaks away substantially larger cuttings than conventional bits would make in the same rock. The design is patented.

Here are the proven advantages of the Circle-Set bit design

1. FASTER PENETRATION—The Circle-Set design produces relatively large cuttings and provides for rapid removal of cuttings from the bit face.

2. LONGER BIT LIFE—Less bit pressure is needed for good penetration because the Circle-Set design makes it unnecessary to cut the rock into extremely fine particles. Diamonds are oriented in a hard vector direction, giving more cutting per unit of diamond wear.

3. LOW FIRST COST—Fewer diamonds are needed for good cutting action because the design makes large cuttings break away easily from the sides of the grooves.

4. LOW COST PER FOOT—Faster penetration, good footage and lower carat weight combine to reduce drilling costs substantially.

5. HIGH BIT SALVAGE VALUE—Diamond losses are lower since the diamonds are oriented in a hard vector direction and supported by metal in the ridges.

6. GREATER STABILITY—Core barrel and drill string vibration is often noticeably reduced since concentric rings on the face ride *inside* the grooves cut in the rock.

7. IMPROVED CORE RECOVERY—Core recovery is improved in many formations because this stability and the sharp I.D. corners help cut the core cleanly away from the rock.

8. REDUCED NEED FOR HIGH BIT INVENTORIES—The Circle-Set bit's one basic design does well in many drilling conditions.

9. POPULAR SIZES AND TYPES ARE AVAILABLE FROM STOCK.

Because Circle-Set bits can reduce costs while other drilling expenses continue to increase, they are destined to become important in many diamond drilling operations.

For complete information and prices of Circle-Set bits, write:

E. J. LONGYEAR COMPANY

76 South 8th Street • Minneapolis 2, Minnesota

CANADIAN LONGYEAR, LTD., NORTH BAY, ONTARIO

LONGYEAR, N.V., THE HAGUE, HOLLAND

LONGYEAR ET CIE., PARIS, FRANCE

Longyear

• *Mining Engineering and Geological Consultants*

THE WORLD IS OUR WORKSHOP

PROJECT PAYDIRT* *pays off again*

NEW 225 HP CAT NO. 619 TWO-WHEEL TRACTOR

First two-wheel tractor to deliver four-wheel speed and roadability!

Matched with new No. 442 Series B LOWBOWL Scraper for new high production with 14 cu. yd. struck capacity!

This new No. 619 Series B represents a major breakthrough in two-wheel tractor-scraper design. It is the first and only broad application two-wheel machine that combines two-wheel traction with four-wheel speed and roadability. It also affords new unit construction and timesaving accessibility never before built into this type of rig.

The No. 619's new turbocharged engine delivers 225 HP and a torque rise of 20% — for fast acceleration. With a top speed of 30.2 MPH, the No. 619 can really run—and run under conditions that slow down other make two-wheel rigs.

That's because of its roadability. Advanced Caterpillar design has achieved a tractor-scraper balance resulting in rides that "smooth out" to an amazing degree. This balance permits higher speeds for more cycles per day and less operator fatigue.

With all this, new hydraulic steering makes the No. 619 extremely easy to maneuver, yet retains that important "feel of the road" touch. Design permits full 90° turns with a turning diameter of 30 feet.

As for unit construction and accessibility, here's one example: A new swing-away dash allows ready access to the starting engine, air compressor and hydraulic pump. Another example: By removing six capscrews in the planet carrier cover, each axle can be removed from the tractor. The planetaries are interchangeable between sides.

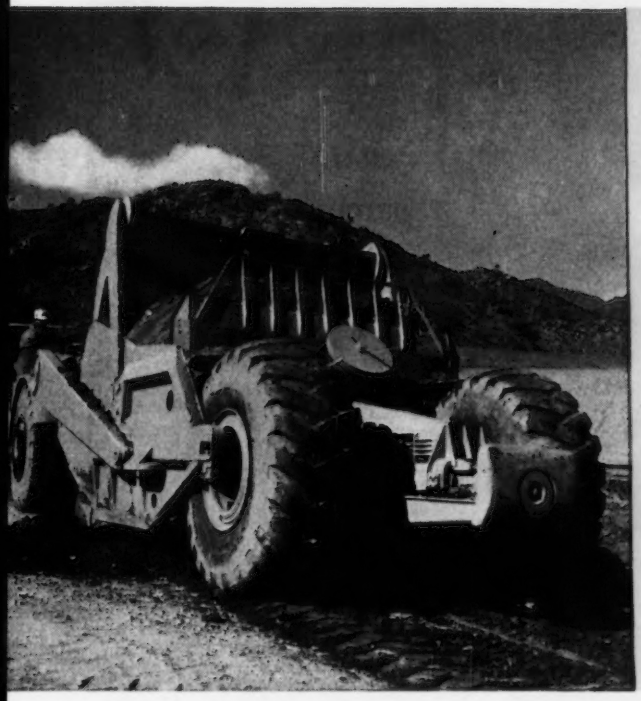
Like all achievements of Caterpillar's Project Paydirt, the No. 619-No. 442 unit has been thoroughly tested. Four years of on-the-job operation prove this: This new "all-job" machine will set new performance records on a broad range of applications.

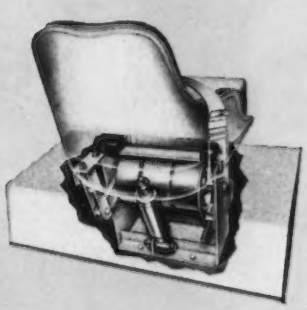
How much does this mean to you profit-wise? Of course, that depends on your jobs. But this is certain—there's nothing like the new No. 619-No. 442 in the field today. Get the complete facts about it from your Caterpillar Dealer, who backs you with round-the-clock service and parts you can trust. Ask for a demonstration. See for yourself how it can step up production and profits on a wide range of applications.

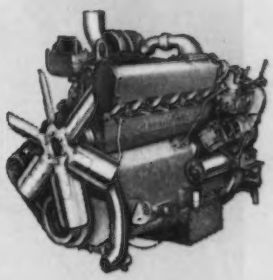
Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

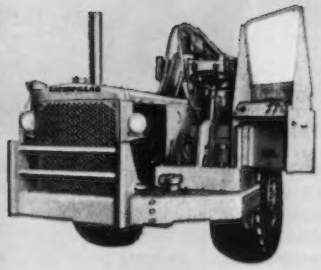
NEW TORSIONFLEX SEAT. New seat provides "highway" ride on off-highway conditions. Helps conserve operator's energy, lessens his fatigue, enables him to do more work per shift. One of many Caterpillar developments.

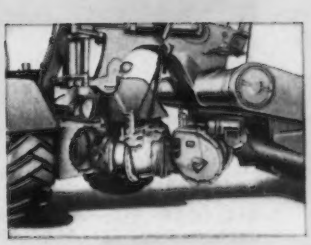
NEW TURBOCHARGED CAT ENGINE. Designed to meet the specific requirements of the No. 619. Develops 225 HP and a full 20% torque rise—for fast acceleration from cut. Fuel system permits use of economy-type fuels.











NEW NO. 442 SERIES B LOWBOWL SCRAPER. Matched to the No. 619 for high production. Capacities: 14 cu. yd. struck and 18 cu. yd. heaped. Exclusive Caterpillar LOWBOWL design provides a faster loading rate with less resistance throughout the loading cycle. Also available for use with the No. 619 is the 25-ton-capacity Athey PR619 Rear Dump Trailer.

NEW SWING-AWAY DASH. Permits timesaving access to the starting engine, air compressor and hydraulic pump. Entire left side of engine can be exposed without having to disassemble any major components connected with dash.

NEW UNIT CONSTRUCTION. Offers unmatched accessibility for servicing. Transmission differential and cable control can be quickly removed as unit. Each axle can be pulled out by removing six capscrews from planet carrier cover.

Additional facts about the No. 619-No. 442—Six-speed forward, two-speed reverse constant mesh transmission • Standard wide-base 26.5-25, 24-ply tires all around—optional tread and ply ratings available • Choice of in-seat gasoline starting or direct electric starting • New dry-type air cleaner • Fuel tank capacity—85 U. S. gallons • Shipping width—10 feet, 10 inches.

CATERPILLAR'S PROJECT PAYDIRT

***PROJECT PAYDIRT:**

Caterpillar's multimillion-dollar research and development program—to meet the continuing challenge of the greatest construction era in history with the most productive earthmoving machines ever developed.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

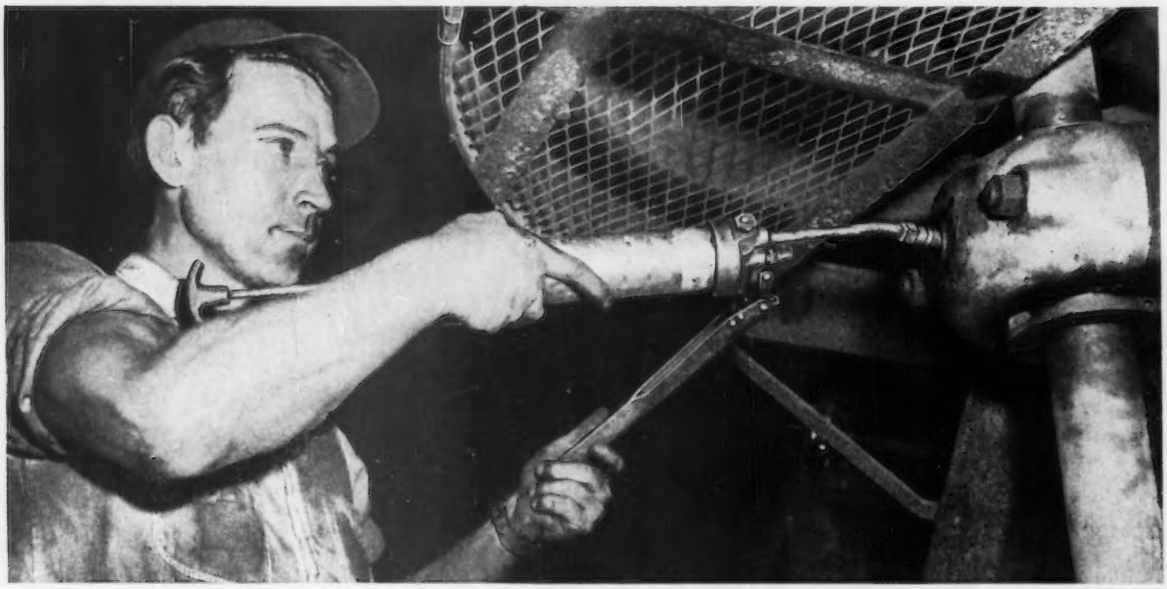
BORN OF RESEARCH
PROVED IN THE FIELD

ENGINEER'S FIELD REPORT

PRODUCT CHEVRON INDUSTRIAL GREASE

FIRM CALERA MINING CO. Cobalt, Idaho

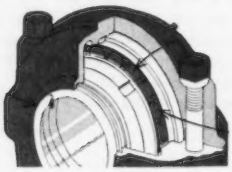
Bearings last 800% longer using Chevron grease



Escaping 240° steam caused bearing failures in only 2 months on this ore conditioner at Calera Mining Co. until firm changed to Chevron Industrial Grease. Now, identical bearings lubricated with this moisture—high temperature-resistant grease last 18 months, 800% longer...need lubrication just once each 24 hours instead of 3 times every 8-hour shift. Bearings are pillow blocks for 17½' impeller shaft which churns ground cobalt ore with steam, air and lime to aerate it prior to differential flotation.

Mill Foreman J. O. Vecchies (right) and V. Fliflet, Standard Oil Representative, stand on 15' diameter ore conditioner to examine bearings and impeller drive. Replacing these 3-3/16" taper roller bearings is a 4-hour, 2-man job, and shuts down entire mill. Increased bearing life with Chevron Industrial Grease saves the equivalent of 64 hours labor, with a corresponding increase in productive capacity. Mill is only source of cobalt in Western Hemisphere. Firm has used Chevron Industrial Grease since 1955.

Why Chevron Industrial Grease provides superior lubrication



- Top wear-prevention qualities
- Pumpable over wide temperature range
- Mixes with any grease
- Extreme work stability
- Melting point, 500°F. plus
- Rust protection
- Non-corrosive
- Unusual water resistance

For More Information on Chevron Industrial Grease or any other petroleum product, or the name of your nearest distributor, write or call any of the companies listed below.

CHEVRON Industrial Lubricants

TRADEMARKS "CHEVRON" AND CHEVRON DESIGN REG. U.S. PAT. OFF.

STANDARD OIL COMPANY OF CALIFORNIA
225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY
P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS
P. O. Box 862 • El Paso, Texas

E&MJ NEW PRODUCTS DIGEST

In this issue—a reagent controller, an electric rock drill, all-welded aluminum mine cars, a tunnel borer, a 46-in. dia Grant bit, Ford's experimental gas turbine and many other items.

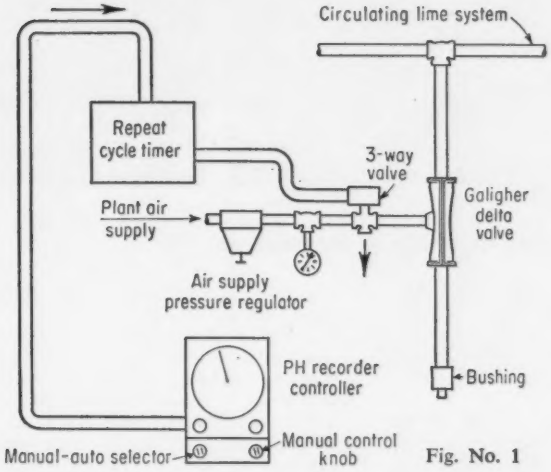


Fig. No. 1

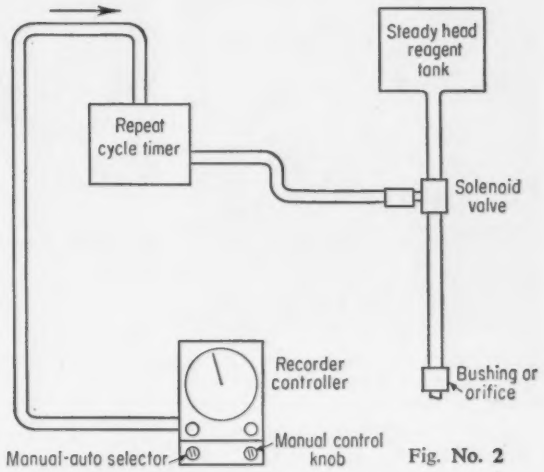


Fig. No. 2

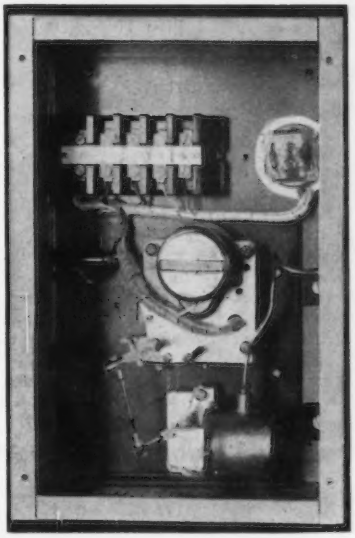
Time Modulated Reagent System Controls Feed Rate Accurately (1)

INDUSTRIAL PHYSICS & Electronics Co's new time modulated reagent control system provides an inexpensive and reliable means of controlling the addition of small amounts of reagents accurately and of reagents in slurry form found to be a difficult control problem in many mills and plants.

For instance, in many flotation mills it has been difficult to obtain a grade of lime that is free from sand and other abrasives. When attempts have been made to employ control valves of conventional design it has been found that they will erode and cut out within a few days. Application of rubber-lined Saunders patent valves equally proved unsatisfactory because they, too, quickly cut out, chiefly because they tend to close along a line when throttled toward the closed position. This results in high velocities through the valve, as well as the possibility for the valve to plug.

The valve used in conjunction with the I.P.&E.Co time modulated reagent control system and designed for slurry feeding is the Delta valve developed by the Galigher Co. Rubber-lined, it uses either air or hydraulic fluid to effect closure. Air is admitted to both halves of the valve between the valve body and the rubber lining. The valve is closed by admitting the air (or hydraulic fluid) at sufficient pressure to collapse the rubber lining against the pressure of the system. Release of pressure opens the valve.

The valve is operated either completely open or completely closed. Control is effected through the time that the valve is open or closed. It is operated on a 10-sec repeat cycle with the percentage of time that the valve is open variable from 1 to 100% of the 10-sec cycle.



SMALL amounts of reagents, even in slurry form, can be fed accurately.

If 50% lime feed is wanted, the valve is open 50% of the time and closed 50% of the time. If 25% of the total lime feed is wanted then the valve is open 25% of the time and closed 75% of the time, etc. In general, a bushing or limiting orifice is employed to limit the maximum flow of material through the valve when it is open 100% of the time.

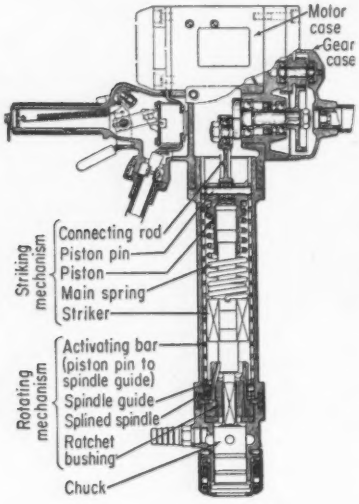
It is thus possible to control the valve from a minimum to a maximum flow of material. Since there is no throttling of the valve, erosion of the valve is not a problem. The valve is not closed long enough to allow the slurry to settle and pack, thus ruling out line plugging. The 10-sec time cycle is sufficiently rapid so that for all practical purposes the flow of material may be considered continuous. The process is not affected.

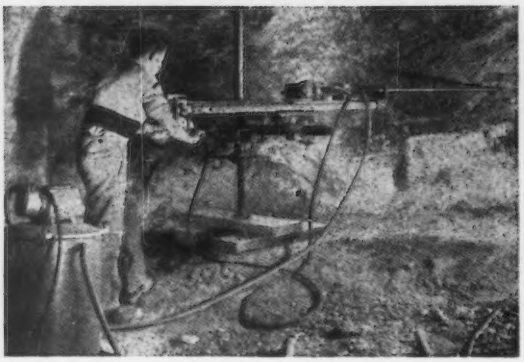
For hand operation, a manually set electrical interrupter is used. A precision pneumatic interrupter is employed for automatic operation. This unit operates from a standard process control signal of from 3 to 15 psi. At 3 psi the valve is opened 100% of the time, and at 15 psi pressure on the pneumatic interrupter the valve is closed 100% of the time. At points in between these extreme pressure, the valve is opened or closed a proportionate amount of the time to an accuracy of ½ %. As a consequence, the system is ideally adapted to automatic process control.

Fig No. 1 shows the general arrangement of the valve for automatic control. A three-way valve is operated to apply a pneumatic signal to the Delta valve with the signal being great enough to close the valve against the line pressure of the reagent system. The Delta valve will close with an applied pneumatic (or hydraulic) pressure only 5 psi greater than the line pressure. Constructed from live rubber and fabric, the Delta valve has a relatively long life.

Where it is desired to control the feeding of minor amounts of reagents such as pine oil, xanthate, and others, the Delta valve is not practical. In such an installation a simple solenoid magnetic valve is employed instead. Downstream from the magnetic valve an orifice is inserted in the line, the orifice being made of sufficient size to deliver the maximum required flow when the solenoid valve is open 100% of the time.

WET WORK in underground mine is done with water flush but in dry work suction or pressure air flush is used, see right.





Electric Percussion Rock Drill Developed (2)

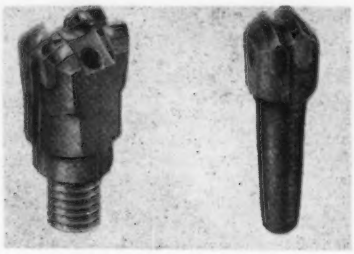
SMOOTH-HOLE reaming effect of positive rotation together with the power efficiency and compactness of an electric drive have been achieved in a 65-lb rock drill made by Robert Bosch Gmbh in Germany and sold in the U.S. through Homelite Corp. Speeds of 6½ ft per minute have been reported in Bolivia. According to Homelite, there are no adjustments on the drill so trained operators are not required and no daily maintenance or lubrication is necessary.

The machine can drill 2-in. holes over 20 ft deep or 4-in. short holes. It can be used as a sinker, on an air-leg or on a feed-shell. Flushing is by either air or water, through the rod using a swivel head at the chuck. The air flush, either suction or pressure, is furnished by a separate portable unit. Bosch offers 90-lb (including dust collector) or 40-lb units respectively but Homelite has a 21-lb pressure unit.

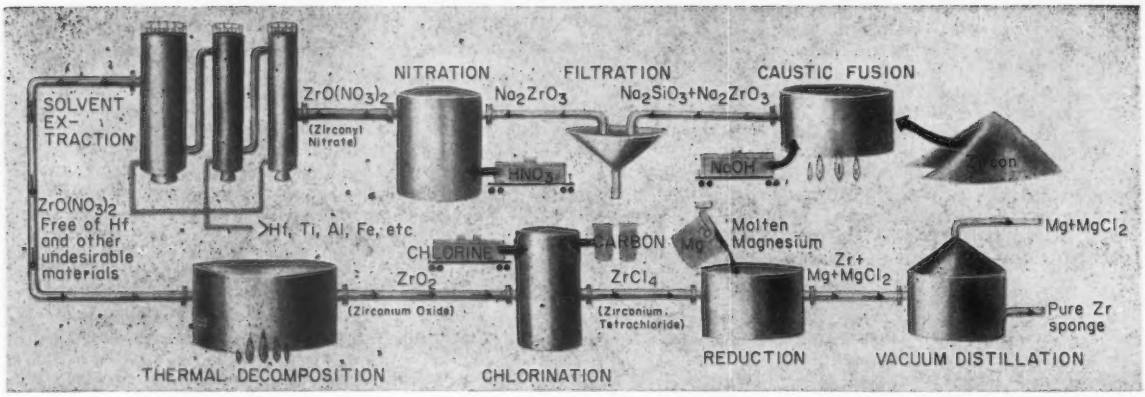
The 80-rpm rotation is independent of the 1,450-blows per minute percussion. The rotation is effected on the upstroke of the piston directly from the motor through the gear train, connecting rod, piston pin, activating rods and spline, ratchet and pawl mechanism. Percussion is accomplished by the piston working through a spring-loaded striker which delivers an 11-ft-lb blow to the drill steel through the chuck.

The 1.2 kw, 265 or 120 v, 200 cycle ac used in the machine can be furnished through a 200-lb frequency changer attached to a normal 3-phase power line or by a 450-lb movable diesel generator or by a 143-lb gasoline generator. The generators also power the air flush unit.

The machine can use standard U.S. drill steel rods (including ⅞ in. hex) and tungsten carbide bits. But the German drill string consists of 1-in. round rods (auger scroll optional) having a ½-in. center hole and bits having male type connection with lamp-socket threads or conical taper and having some unusual wing designs (see photo).



How Badger Manufacturing Designed Columbia-National's Zirconium Plant (3)

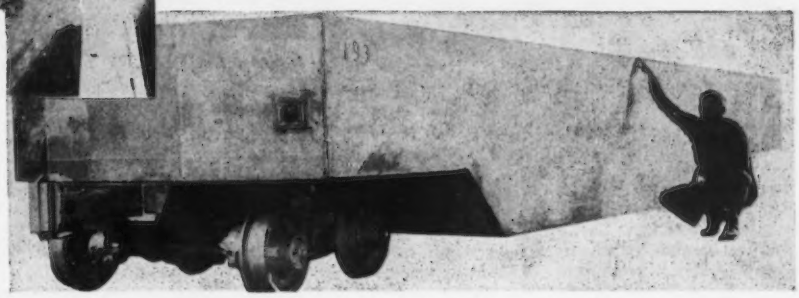


EIGHT-PAGE bulletin illustrates the creative engineering and broad experience of Badger Mfg. Co.

All-Welded Aluminum Mine Cars To Be Tested (4)

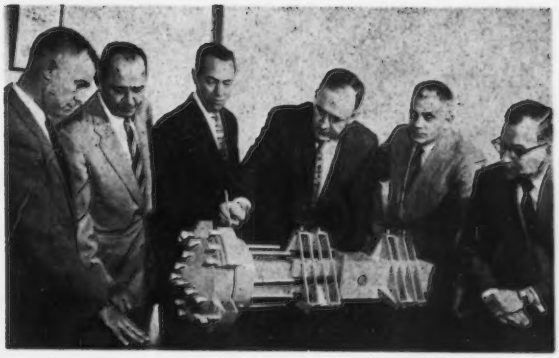
Watt Car & Wheel Co., for many years a fabricator of aluminum mine cars, has completed construction of ten all-welded aluminum cars that will be tested at Hanna Coal Co.'s Ireland mine, Moundsville, W. Va. Aluminum cars, while costing more than steel ones, are 35% lighter. Reduced weight means that more cars can be used (and more ore hauled) with the same size locomotive. All parts for the entire order were cut from ½ and 5/16 in. aluminum alloy 6061 TG before assembly began. Cars were tack welded, and then finished with 1300 ft of Sigma welding (mostly fillet work). Sigma welding is a product of Linde Co.

EACH CAR is 26 ft long, 7 ft wide and 4 ft deep, and weighs 7,580 lb. Capacity is 15 ton. Trucks and draft gear are steel fastened to the body by aluminized-steel carriage bolts. Tests at Hanna Coal will tell whether or not the new alloy can stand the wear and tear, but aluminum mine cars have been used in some U.S. coal mines for years.



Phillips Pet Sinks 46-in. Ventilation Shaft (5)

Using a Terminal Drilling Co. drill-team and a 46-in. dia Grant bit, Phillips Petroleum Co. drilled a ventilation shaft from the surface 1432 ft into the depths of Ambrosia Lake. The 46-in. dia bit was followed by two Grant 46-in. reamers; then the hole was cased. The shaft was sunk in stages. First a 15-in. pilot hole was driven; then enlarged successively to 26-, 36- and 46-in. dia. Circulation through the bit was maintained by two 7½x14-in. pumps. Drill pipe was 5 9/16-in. dia. Three 8 in. x 40 ft drill collars were used. Casing was a 36-in. dia pipe with a wall tapered from ⅝ at the top to 1 in. thickness at the bottom. Terminal Drilling also did a 500 ft, 36-in. dia hole for the AEC.

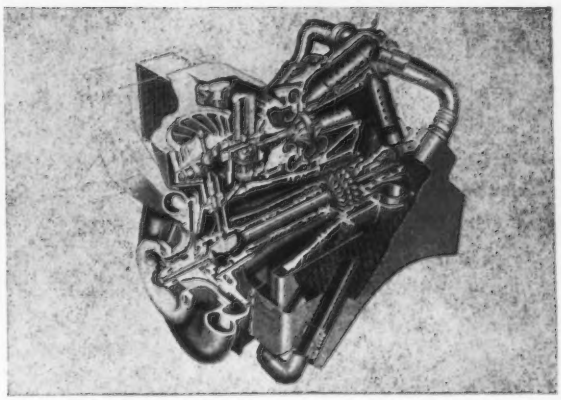


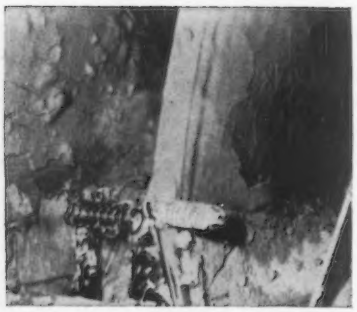
Borer Drives Eighteen Foot Opening (6)

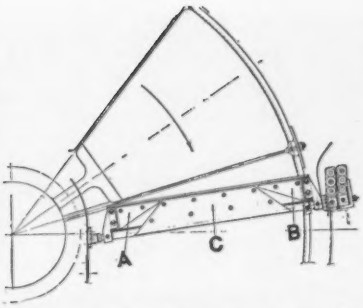
The model displayed above is the result of several years effort by Hughes Tool Co.—a shaft and tunnel-driving borer that employs Hughes' rock bits and oil-well drilling techniques for hard rock work. Presently, Hughes is concentrating on the cutting bit design, but has assisted other manufacturers in the development of the machine parts. Units will be powered electrically and operated by hydraulics.

Ford Gas Turbine Develops 300 Horsepower (7)

The Ford Motor Co. 704 gas turbine differs radically from others already available—dual combustion chambers, maximum fuel economy in a range of 25 to 100% of power, 650 lb weight installed (a diesel truck engine of same horsepower would weigh about 2,700 lb according to Ford) condensed into a package small enough to fit under the hood of a Ford automobile. The 704 will burn unleaded gasoline, kerosene, jet fuel or light diesel oil and will develop about 300 hp. Ford expects to test the engine in vehicles on the road before the end of 1959.





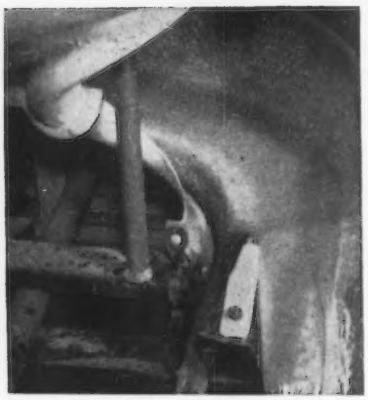


Filter Disc Scraper Has Contour Design, Improves Filter Capacity (8)

A scraper developed by Peterson Filters & Engineering Co. will increase a conventional disc filter's capacity by thoroughly cleaning the cloth. Straight filter scrapers tend to scrape only the center portion of the disc, leaving cake on the inner and outer edges to be refiltered. The result is a lumpy cake with only 60 to 80% effective cake discharge. New contour design is a three-sectioned scraper as shown above. Each plate is hinged independent of the others. As a bag inflates, the central plate contours to the shape of the inflated bag while the inner and outer sections hold in place. In the photo above, the bag at the left has a conventional scraper; that on the right a Peterson Contour scraper.

Synthetic Graphite (9)

National Carbon Co. has developed a revolutionary process that converts organic textiles directly into graphite with a purity in excess of 99.9% carbon. Any textile form of yarn, braids, felts and fabrics that are woven or knit can be converted to graphite. For example, rayon can be graphitized by electrical heating to 5,400 deg F where a thermochemical conversion changes the crystalline structure of the material to that of graphite. Refractories, electrical conductors, filter bags for hot dust collectors up to about 750 deg F, electrostatic precipitators, flame arrestors, curtain walls, the handling of corrosive fluids on a filter, self-lubricating bearings, conveyor belting and electron wiring are but a few of the potential outlets.



Fiberglas Spiral (10)

Several Australian rutile and zircon producers have been able to cut their costs of production and to improve the efficiency of their operations through the use of a locally-designed and patented lightweight Fiberglas wet spiral separator. The new unit, now exhaustively tested, does away with most of the important shortcomings of other types.

Developed by technicians of Hortz Trading Co., Southport, Queensland, Australia, the spiral preconcentrator takes a bigger head feed, requires less personal attention and results in a minimum of tailings loss. It is not particularly sensitive to pulp density or the rate of feed. Splitters have been deleted and wash water is the only medium of splitting used. The same wash water is also used to transport the minerals to the launder. This has been achieved only after a close study of the shape of the helical chute and the particular method of taking mineral off to the inner launder. On some materials, fully satisfactory results have been obtained on head feeds in excess of three long tons per hour.

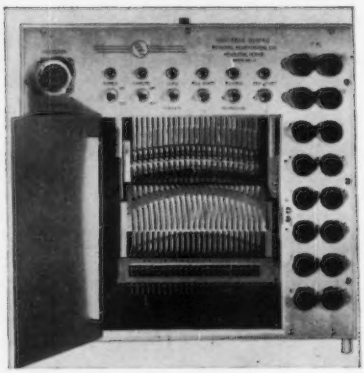
Beach sand minerals producers purchase units of two spirals, one left hand and one right hand, mounted in a special frame for ganging.

Mine Hoist Rope (11)

Mine hoist rope with electrical conductors embedded in the fiber core, where the conductors are protected from injury, makes it possible to communicate through the shaft rope. According to Colorado Fuel & Iron Corp.'s Wickwire Spencer Steel Div., the wire hoist rope can be zinc socketed without damaging the conductor cables. Suitable arrangements are provided to connect to both ends of the rope. Telephone communications and skip location signals, and even the dumping of the skip can be conducted through the wire. Check for more data and sizes available.

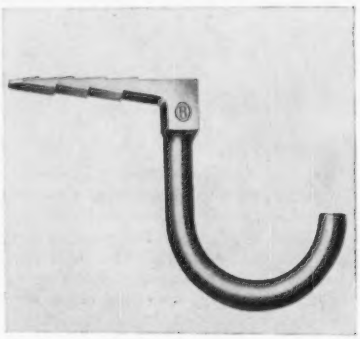
New Address

Equipment Engineers, makers of the Krebs cyclone, have moved into a new office, pilot plant and laboratory at 737 Loma Verde Ave., Palo Alto, Calif.



Portable Geopac (12)

A portable Geopac unit which allows the production of fully corrected seismic records in the field and which provides extreme flexibility with respect to types of ground spreads is available from General Geophysical Co.



Roof Bolt Plate Hook (14)

Trailing cables and pipe up to 2½ in. dia can be supported easily from bolted roofs by means of the Ohio Brass Co. roof plate hook. Hook is installed by hammering the serrated arm between the plate and the roof.

Koehring Buys Drill Maker

Stardrill-Keystone Co., a maker of drills and rigs from one to 60 in. dia to depths of 3,000 ft, has been purchased by Koehring Co. In 1958, Koehring purchased Ka-Mo Tools Co., another drilling equipment manufacturer.

For Your Files

This selected manufacturer's literature is free unless otherwise specified. If item is for sale, send request and money direct to manufacturer.

Exploration and Mining

CAMP AND TRAIL FOODS—survival kits, standard trail units, emergency units, or you name it—packaged by Bolton Farm Packing Co. Inc. are listed with prices in a 24-page catalog. **(60)**

EXPLOSIVES BAG recently announced by Bemis Bros. Bag Co. is discussed in an 8-page booklet entitled "13 Questions and Answers". **(61)**

CEMENTED CARBIDES FOR INDUSTRY—metal working tools, blanks and indexable inserts from Carmet Div., Allegheny Ludlum Steel Corp. are tabulated in a 30-page catalog. **(62)**

GALE-GUARDS for material handling bridges are the subject of a four-page bulletin prepared by Crane & Bridge Sales Div., Dravo Corp. **(63)**

SIDE-TIPPING BUCKET attachment for crawler tractors—said to be the only bucket designed to tip its load to right or left as well as forward—is illustrated in literature from Libu Shovel Co., AB. **(64)**

DIESELS out-perform gasoline engines, is the title chosen for an 8-page bulletin illustrated by General Motors' Detroit Diesel Engine Div. **(65)**

DESIGN improvements, increased power, performance and work capacity of the new Caterpillar Tractor Co. No. 933 Series F Traxcavator are presented in a six-page bulletin. **(66)**

HYDRAULIC SCRAPER—the Euclid S-18 21 cubic yd struck (30 cubic yd heaped), 336 hp unit combines Torqmatic drive with automatic lock-up according to the latest bulletin (No. 511). 15pp. **(67)**

REAR DUMP TRUCK—the Euclid R-10 (10 ton)—for off-highway haulage is presented in an 8-page bulletin. (151-R4). **(68)**

HEAVY DUTY impact tool, the Ingersoll-Rand Co.'s ½-in. drive electric Impactool, is described in a four-page bulletin. **(69)**

LIGHTWEIGHT, portable air hoists for the busy machine shop are illustrated in Ingersoll-Rand Co. bulletin (N.R.8-59). **(70)**

TURBINES, turbo-alternators, gas and steam turbines, transformers, etc. from Brush Electrical Engineering Co., Ltd. are discussed in a 19-page bulletin. **(71)**

INSTRUMENT and control switch bulletin (2954) made available by Allis-Chalmers Mfg. Co. describes the features and advantages of A-C Type 210 switches. 8pp. **(72)**

STORAGE BATTERY maintenance manual for diesel-electric locomotives published by Exide Industrial Division, Electric Storage Battery Co. contains a step-by-step "how to" on getting the best service out of the equipment. **(73)**

Mineral Processing

MOTOR REDUCERS by Falk Corp. in all-steel Motorreducer line are thoroughly illustrated in a 27-page bulletin (3100). **(74)**

COMPOSITE PRODUCT bulletin (518) published by American Air Filter Co., Inc. contains a description of the company's complete line of products. 16pp. **(76)**

DUST CONTROL bulletin on the Type D Roto-Clone is available from American Air Filter Co., Inc. (272B). 20pp. **(77)**

DUST COLLECTOR bulletin on American Air Filter Co., Inc.'s line of high-velocity electronic air cleaners with rated efficiency of 97% is available. (258A). 16pp. **(78)**

FLUID BED DRYER—a Heyl & Patterson, Inc. design—is illustrated in a six-page bulletin (159). **(79)**

HOW TO INCREASE grinding mill efficiency—a descriptive bulletin on techniques—has been published by Colorado Fuel & Iron Corp. 8pp. **(80)**

HEAVY DUTY SCREENS in the Mesabi line of Pioneer Engineering

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E&MJ NOT GOOD AFTER NOV. 1, 1959 **MAY 1959**

Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	11	21	31	41	51
2	12	22	32	42	52
3	13	23	33	43	53
4	14	24	34	44	54
5	15	25	35	45	55
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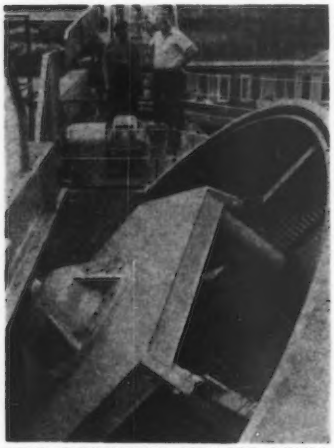
Div., Poor & Co. are displayed in a 16-page bulletin (651A). **(81)**



THE DREWBOY HEAVY MEDIUM vessel, mentioned in *E&MJ* December 1958 New Products Digest, is the trade-mark of Preparation Industrielle des Combustibles (PIC) and has been licensed to Fried. Krupp in Germany and Simon Carves in England. The apparatus is also patented in the U.S., and will be soon distributed in the Far East.

Drewboy process literature and the other data from the company are available upon request. As of July 1958, 118 Drewboy installations were in operation, mostly in coal cleaning. Capacity can reach 1,000 tph, depending on the type of coal, using magnetite or other media. **(82)**

INDUSTRIAL WASTE and domestic sewage flotators designed by Process Engineers, Inc. Div., Eimco Corp. are illustrated in an 8-page bulletin. (SM-1003). **(83)**

STRIPA PROCESS of sink-float separation is the title of a 20-page bulletin authored by Gote Erikson, superintendent, Stallberg Mining Group for Canadian Vickers Ltd., Canadian process sales agents. Illustrated. See *E&MJ* February 1957, p 136 for brief process description. **(84)**

DORR-OLIVER PUMPS for hot or cold corrosive and slurry services catalog contains five pump bulletins, describing the complete line. 22pp. **(85)**

TEMPERATURE measuring, controlling and recording, and indicating devices available from Thermo Electric Co., Inc. are detailed in a thick, thumb-tabbed catalog — thermocouples, resistance bulks, connectors, panels, switches, instruments, etc. **(86)**

MATERIAL HANDLING booklet No. 1 "The Library of Know-How" and a reprint from FACTORY entitled "Building to Fit Your Handling Job" are available from the Material Handling Institute, Inc. **(87)**

THE MINET universal belt repair method is illustrated in a four-page bulletin prepared by General Splice Corp. **(88)**

FILTER FABRICS available from TechFab, Inc. are described in an 8-page bulletin. **(89)**

BELT CONVEYORS catalog prepared by the Industrial Div., Materials Handling Dept., Continental Gin Co. offers comprehensive engineering data and information for the proper selection of belt conveyors and related equipment (ID-591). 88pp. **(90)**

INDUSTRIAL SPRAY nozzles in the line available from Wm. Steinen Mfg. Co. are detailed in a 32-page illustrated bulletin (59). **(91)**

FLUID FEEDER BULLETIN on the B-I-F Industries, Inc. improved Model 1140 Proportioneers Adjust-O-Feeder fluid proportioner is off the press. (1140.20A-1). 4pp. **(92)**

BELT-METER continuous weighing and controlling systems bulletin (2M) just published by Trans-Weigh Co. describes the complete line of equipment used for automatic process weighing and controlling. 8pp. **(93)**

GOLD FOR INDUSTRY and the arts is the title of a 12-page brochure prepared by Chemical Div., Engelhard Industries, Inc. which answers scores of questions about the uses and methods of gold plating, and many other questions about the industrial and decorative applications of gold. **(94)**

SODIUM SULPHITE (anhydrous technical grade) technical bulletin on the use of the compound to remove oxygen from boiler feed water has been prepared by Monsanto Chemical Co. **(95)**

OPTICAL PRODUCTS from the Bausch & Lomb Co., can be examined through the latest 24-page illustrated index to the company's bulletins. **(96)**

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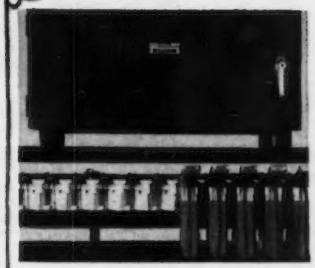
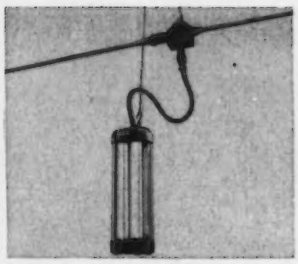
☐ **EDISON R-4 ELECTRIC CAP LAMP** provides brilliant, unfailing light. Assures greater safety for the miner, higher production for the operator. Easy to use and maintain. Adapts to any lamp distribution system.



☐ **M-S-A® AUTOMATIC LOW-VOLTAGE SYSTEM** is designed for the most economical method of lamp charging. Miners can put their lamps on charge with one motion and keep moving without any delay.



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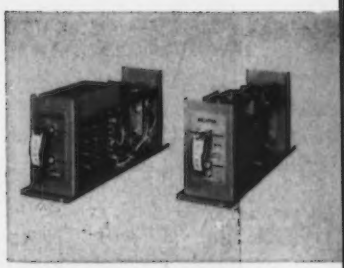
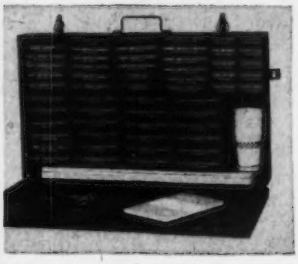


☐ **M-S-A TRANSISTORIZED AUDIO TONE TRANSMISSION EQUIPMENT** permits economical centralized control and indication of fans, substations, motors, pumps, conveyor belts, switches, circuit breakers, and lights.

☐ **M-S-A MINEPHONE** coordinates trip traffic for safe, fast, productive haulage control. Motormen have clear, instant voice communication with the dispatcher or other motormen while trips are moving.



☐ **M-S-A MINER'S FIRST AID CABINET** provides medical dressings and equipment for mine hospital or dressing station. Each unit package individually wrapped in cellophane. When open, lid serves as a work shelf.

☐ **M-S-A ALL-SERVICE® MASK** with new Window-Cator canister, external check valve and M-S-A Cleartone Speaking Diaphragm gives dependable breathing protection against smoke, toxic gases and fumes.

☐ **M-S-A CHEMOX® BREATHING APPARATUS** completely safeguards breathing while travelling through any gaseous or oxygen deficient area. Generates its own oxygen supply from replaceable canister.

☐ **M-S-A SELF-RESCUER®** gives immediate breathing protection in emergencies caused by fire or explosion. Compact. Lightweight. Can be stored without deterioration. Available in storage cases or individual carrying cases.

☐ **M-S-A DUSTFOE RESPIRATOR** is light and compact for dependable protection against dusts, vapors, and mists. Allows maximum vision by the wearer. It's easy to clean. Design is modern and functional.

☐ **M-S-A CHEMKLOS** are made throughout of Dynel. These serviceable gray work clothes resist acids, caustics, mildew and moths. Styled for comfort and good looks. Available in coveralls, trousers and shirts.

☐ **M-S-A TYPE K SKULLGARD HAT WITH NEW FIXED CROWN SUSPENSION** is safest on the outside, safest on the inside. New suspension provides an extra margin of safety which is completely tamper-proof.

☑ CHECK ITEMS OF INTEREST

We will furnish further details

Check off the MSA products which you would like to know more about. Then tear out this page, send it to MSA. We will send you the additional information requested. An MSA representative will be pleased to relate the advantages of these items to your operation: in terms of full-shift protection, more tons per man. No obligation, ever.

MINE SAFETY APPLIANCES COMPANY
201 North Braddock Avenue, Pittsburgh 8, Pennsylvania

MSA® SAFETY EQUIPMENT HEADQUARTERS

MINE SAFETY APPLIANCES CO. OF CANADA, LTD.
Toronto, Calgary, Edmonton, Montreal, Sydney, Vancouver, Winnipeg

MINE SAFETY APPLIANCES CO. de MEXICO, S.A. de C.V.
Mexico 4, D.F., Mexico

JOB RECORDS PROVE

Firestones meet schedules on the toughest projects!

Where it's rough going for every yard moved, Firestone tires turn downtime into worktime profit! That's because every Firestone off-the-highway tire is job engineered for the toughest duty. They're built with Firestone Rubber-X, the longest wearing rubber ever used in Firestone tires! Firestone S/F (Shock-Fortified) nylon or rayon bodies shrug off bruising shock and impact. Tough Firestone treads and sidewalls work through terrain that often ruins ordinary tires. Call your Firestone Dealer or Store and ask about the full line of Firestone tubeless or tubed off-the-highway tires. He'll recommend the tires that are built for your job! And remember, Firestone off-the-highway tires are backed with on-the-job service!

Rock Grip Excavator® Wide Base Rock Grip Excavator®

When ordering new equipment always specify Firestone tires—available tubeless or tubed

Firestone

BETTER RUBBER FROM START TO FINISH

Enjoy the Voice of Firestone on ABC television every Monday evening.

Copyright 1959, The Firestone Tire & Rubber Company

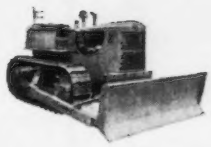
A-C ALLIS-CHALMERS

metal mining modernization

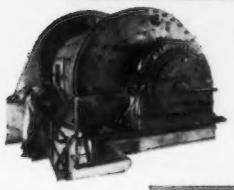
Allis-Chalmers wraps up your complete Processing Package

Earth-moving machines,
processing machinery, electrical equipment
"Coordineered" from plan to plant

HELP FOR YOU OR YOUR CONSULTANTS



EXPERT EVALUATION OF YOUR REQUIREMENTS

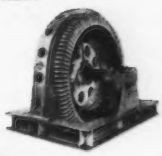


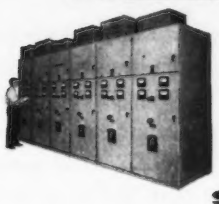
INTEGRATED THINKING, PLANNING, ENGINEERING

COMPLETE LABORATORY AND PILOT PLANT FACILITIES

EQUIPMENT MATCHED FOR TOP EFFICIENCY

UNDIVIDED RESPONSIBILITY FOR PERFORMANCE





MAINTENANCE CHECKUPS, FAST PARTS SERVICE

Send for Bulletin 07B7995

Handy reference offers only scientific method of determining right crusher or grinding mill and required horsepower. See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wis. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Que.

A-5932

Unmatched for speed and economy in

TUNNEL and SHAFT WORK

U.S. Patent No. 2,873,866 — Canadian patents granted — foreign patents applied for on this improved car loading method.

NOW

PATENTED

WHUP 'd WHUP

repeats the story from its 1956 advertisement

Whup 'd Whup is a proven, high-speed, tunnel driving unit . . . an agile and powerful giant . . . amazing time and labor saver that accomplishes the loading of an entire train of stationary cars. Each car is filled in sequence until a complete round is loaded, then all the equipment rides out with the train, clearing the tunnel for a new round of drilling and blasting.

Progress in Mechanized Mucking

The muck is dumped into the end car with an overshot loader, then the slusher bucket, traveling on grizzly rails, moves forward and back lengthwise of the train progressively filling the cars. No switching . . . no waiting for cars . . . no set up time required. Used in combination with our new Drill Jumbo, the Whup d' Whup provides the fastest and lowest-cost tunnel driving available. If you have a drift cross-cut or tunnel problem, you'll appreciate having the complete details. And we'll be glad to provide them on your request.

Machinery Center, Inc.

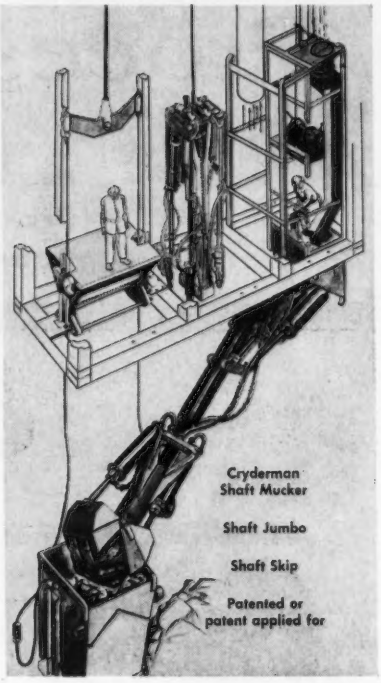
1201 South 6th West • Salt Lake City, Utah • HUnter 4-7601

Shaft & Development Machines Co.

808 Newhouse Bldg. • Salt Lake City, Utah • EMpire 3-5373

CRYDERMAN

Shaft Mucker WITH NEW SHAFT JUMBO AND SKIP

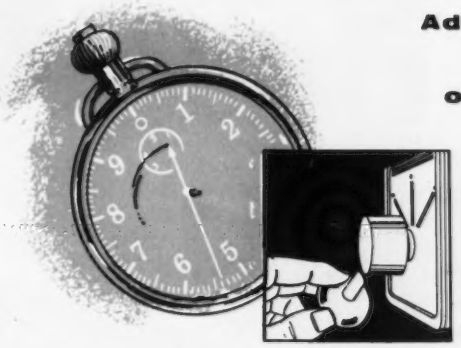


The CRYDERMAN Shaft Mucker is designed to work both vertical and incline shafts. It is a highly maneuverable machine requiring only one man to operate. A collapsible jumbo accomplishes the drilling in record time and fast-action tilt-dump safety skip completes the smooth working cycle of operations. Exclusively a CRYDERMAN creation from custom design to finished products, this rugged equipment is your best assurance of low-cost operation. CRYDERMAN equipment recently sank 24 feet of shaft in 24 hours. Check with us on your mining problems. We provide original ideas and custom equipment for special projects.

metal mining modernization

Savings by the second

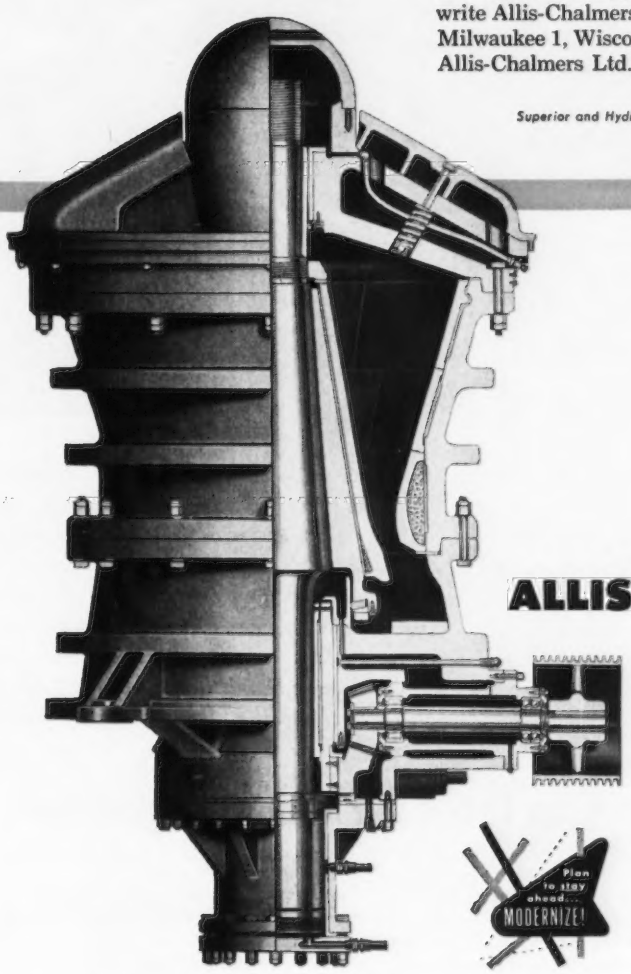
Adjusting for wear is a one-man, one-minute operation on Superior crushers



Even on the largest *Superior* crushers, the time it takes to change settings is measured with a stop watch — not a calendar. The secret is *Hydroset* control. Flip a switch, it's that easy. Remarkable *Hydroset* control also facilitates emergency unloading. Remember, only Allis-Chalmers gyratory crushers offer this profit-building speed and convenience.

Bulletin 07B7870 tells the complete *Superior* crusher story. Get a copy from your A-C representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. In Canada, write Canadian Allis-Chalmers Ltd., Box 37, Montreal, Quebec.

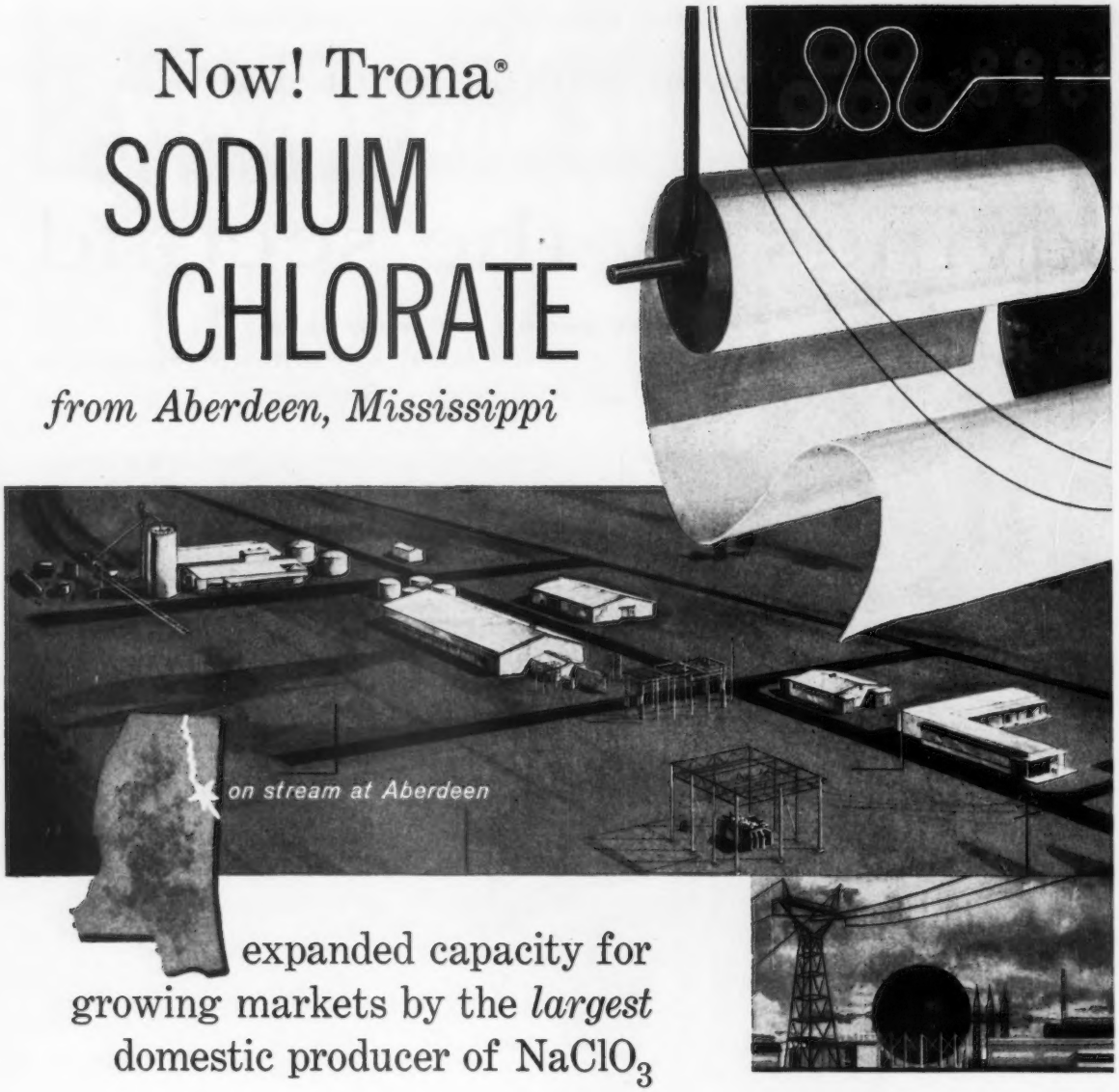
Superior and Hydroset are Allis-Chalmers trademarks.



ALLIS-CHALMERS

A-5933

Now! Trona®
SODIUM CHLORATE
from Aberdeen, Mississippi



expanded capacity for growing markets by the *largest* domestic producer of $NaClO_3$

The big news in sodium chlorate is TRONA's new electrochemical plant, now on stream at Aberdeen, Mississippi. This latest AP&CC facility provides faster and better service to the South's growing pulp and paper production centers, as well as further assurance of dependable sodium chlorate supply for other important markets in such fields as agriculture, uranium ore processing and solid propellant fuels. Aberdeen's readily expandable, initial capacity of 15,000 tons per year, added to the $NaClO_3$ production capability of Trona's Henderson, Nevada, plant makes American Potash & Chemical Corporation the largest domestic supplier of sodium chlorate...capable of meeting *all demands* from expanding commercial and military users. *Further information on Trona's sodium chlorate service and production capabilities at Aberdeen is available from your nearest AP&CC branch office.*

TRONA

American Potash & Chemical Corporation

3000 WEST SIXTH STREET, LOS ANGELES 54, CALIFORNIA
99 PARK AVENUE, NEW YORK 16, NEW YORK
OFFICES: LOS ANGELES, NEW YORK, CHICAGO, SAN FRANCISCO, PORTLAND (ORE.), ATLANTA, COLUMBUS (O.), SHREVEPORT

Producers of: BORAX • POTASH • SODA ASH • SALT CAKE • LITHIUM • BROMINE • CHLORATES • PERCHLORATES • MANGANESE DIOXIDE
THORIUM • CERIUM • RARE EARTHS • *and other diversified chemicals for Industry and Agriculture*

A-C ALLIS-CHALMERS

metal mining modernization

An open motor did what no other motor could... in a mudbath

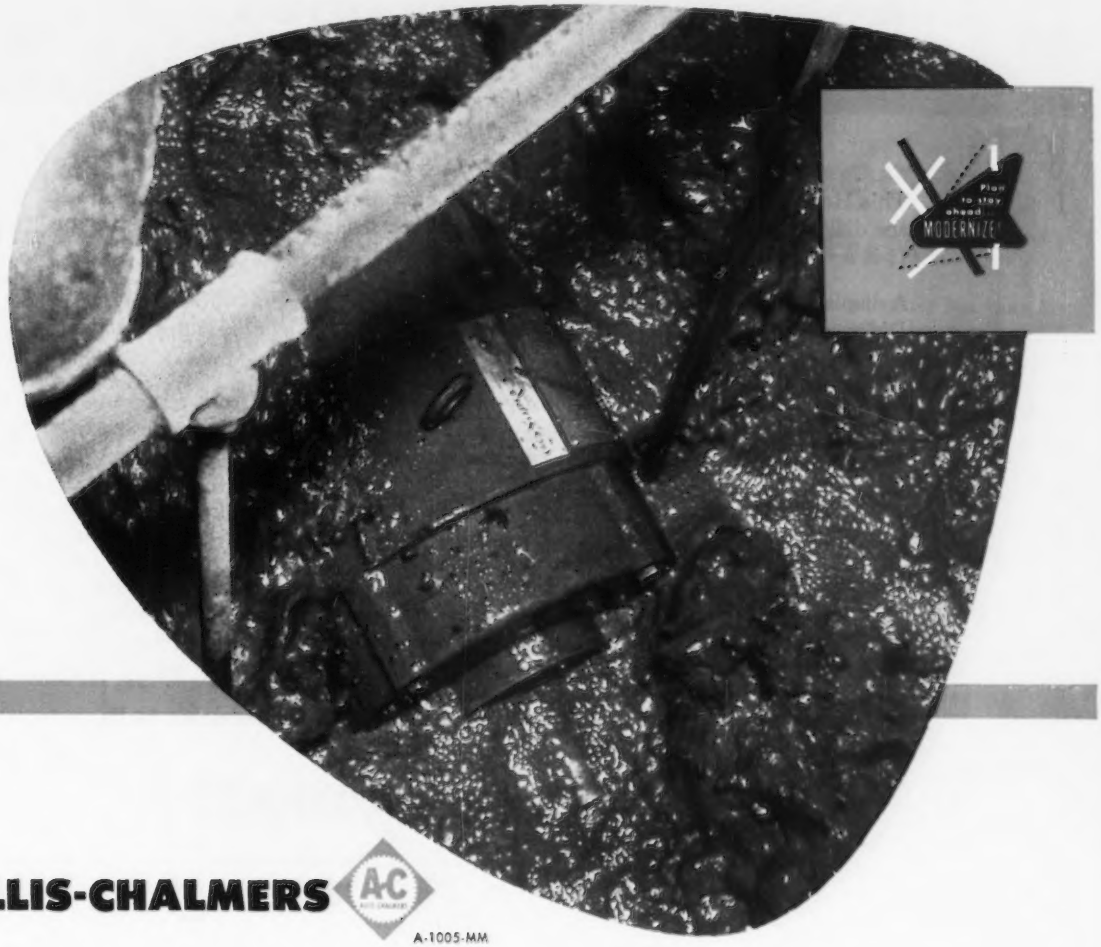
This Super-Seal motor with *Poxeal* insulation and protected bearing was not fouled by mud. An Allis-Chalmers customer, in a frequently flooded area, required a motor that could readily start even after prolonged immersion in mud.

The "dirtiest mud available" was used in conducting the successful tests in the A-C Motor Laboratories.

Motor user requirements like this form the basis for A-C pioneer-leadership in motor development. Motor buyer needs created the most complete line of integral-horsepower motors in industry. Induction, dc, wound-rotor, synchronous, gear, tube-type and *Synduction* motors, and now *Super-Seal* motors! And, if these lines don't fill your need, A-C engineering excels in special design.

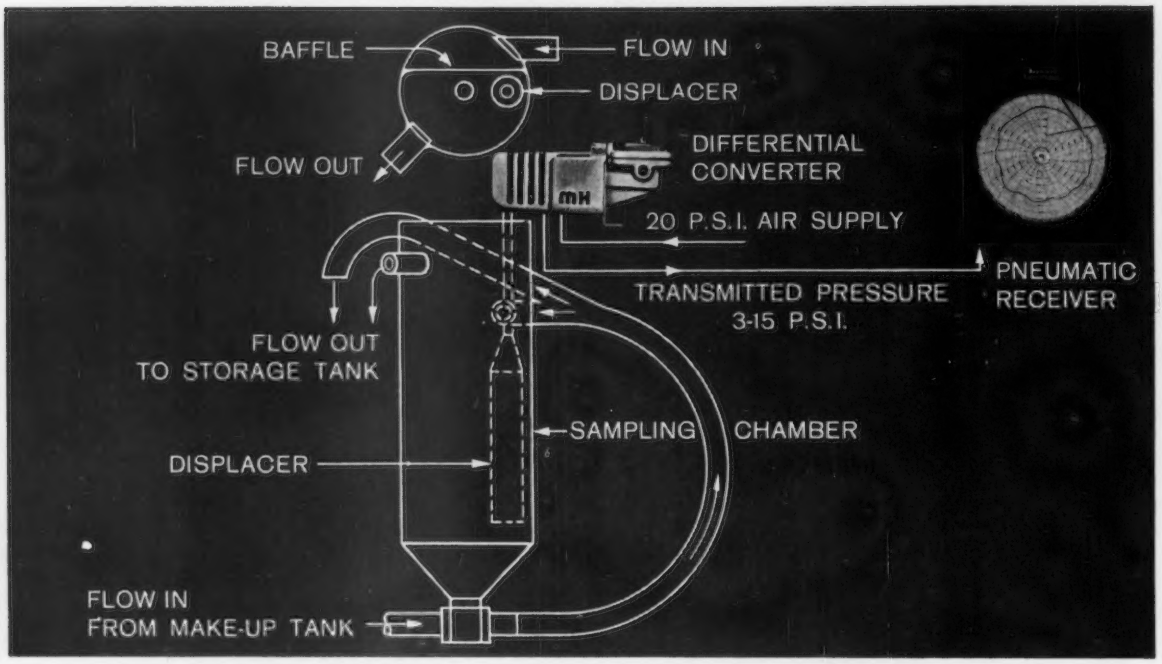
Motor users in the mining industry can benefit from this pioneer-leadership. Contact your A-C representative or distributor, or write Allis-Chalmers, General Products Division, Milwaukee 1, Wis.

Super-Seal, Poxeal, and Synduction are Allis-Chalmers trademarks.



ALLIS-CHALMERS A-C

A-1005-MM



New system measures heavy slurry density . . .

simply, accurately, economically

This Honeywell system eliminates the high cost of radioactive methods and the difficulties of air bubble tube systems for measuring heavy slurry density. It is a simple, accurate displacer system.

A displacer, precisely calibrated for a specific density range, is connected to a *Differential Converter* to provide the density signal. This signal is transmitted to a receiving indicator, recorder, and/or controller.

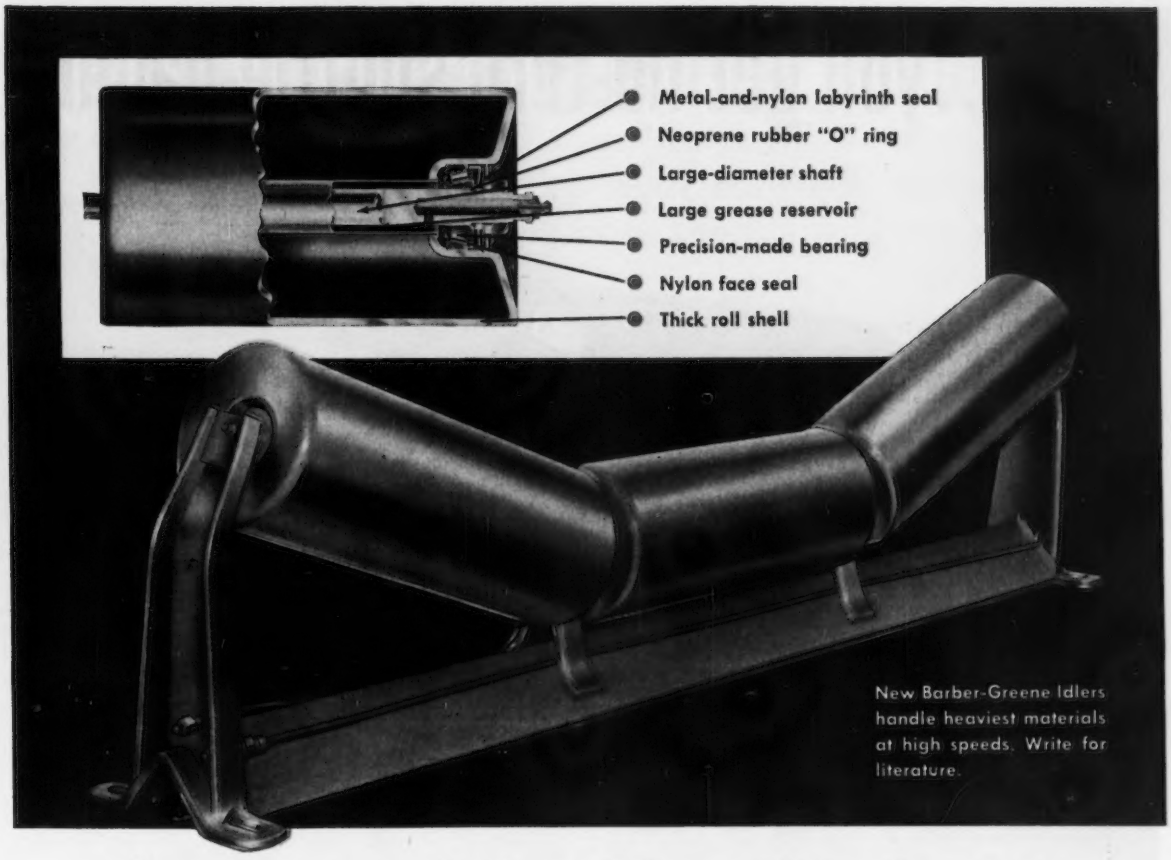
The sampling chamber is designed to maintain the level of a truly representative sample of slurry so that the displacer is kept completely immersed. There's no clogging or build-up of solid material at the bottom of the chamber. Violent pumping surges are eliminated. Necessary circulation is maintained, so that slight changes in slurry density from the make-up tank are immediately sensed by the displacer and transmitted to the pneumatic receiver.

Honeywell supplies the entire system, including the sampling chamber. It is a sensitive, stable and trouble-free means of measurement, and permits the ready addition of conventional controls. Get complete details from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.

Honeywell

First in Control


Metal-and-nylon labyrinth seal
Neoprene rubber "O" ring
Large-diameter shaft
Large grease reservoir
Precision-made bearing
Nylon face seal
Thick roll shell
New Barber-Greene Idlers handle heaviest materials at high speeds. Write for literature.

Increase idler life with these new heavy-duty Barber-Greenes

Barber-Greene's famous line of belt conveyor idlers has now been expanded to include two entirely new series of heavy-duty units. Both series offer many revolutionary design improvements that assure longer life on every job. Both are built to handle large lumps and heavy materials at high speeds. These new series include a complete range of types for every application.

Important advantages are:

Revolutionary grease seals—The combination labyrinth and face seals are the most advanced in the industry. Made of metal and nylon, they seal grease in . . . dust and dirt out, allowing long lubrication intervals and lengthening bearing life. Neoprene rubber "O" rings effectively prevent moisture from entering bearing.

Rugged end brackets—Die-formed carbon-steel end brackets, twice as strong as castings of the same thickness, are ribbed for greater rigidity.

Precision-made bearings—Tapered roller bearings are precision-made to give many thousand hours of service.

Large-diameter shafts—Shafts, made of special-accuracy cold-drawn steel, up to 1¼″ in diameter. They are firmly anchored in stands by sturdy clamps and locking plates.

Virtually unbreakable stands—Jig-welded, all-steel stands maintain roll alignment despite the impact of large lumps. Heavy, inverted base angle is self-shedding. Heavy, formed steel feet up to ½″ thick.

Thick roll shells—Rolls made of heavy steel tubing up to ¼″ thick. Strong welds completely around roll ends assure rugged, long-life units. Roll edges ground smooth to prevent belt wear.

Large grease reservoirs—Rigidly fitted seamless steel tubing forms large grease reservoir, providing ample reserve which permits longer lubrication intervals.

59-9-1PE

Write for new bulletin.

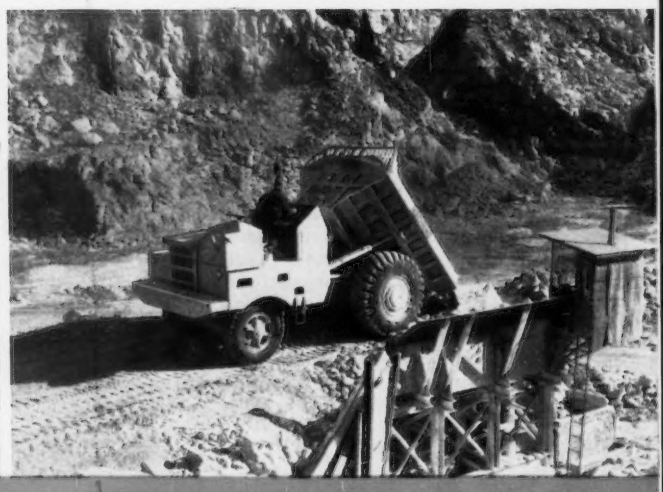
Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

NOW... you get no-turn shuttle-hauling

2-WAY CONTROLS — Operator always faces direction of travel . . . swings around *without leaving seat.* Pivoting seat with 2-way controls lets him operate with equal ease, comfort, safety in either direction. These unique features plus Dumptor's equal speeds in both directions eliminate need for turning at the loader . . . on the haul road . . . or at the dumping area.



2 WAYS TO DUMP — During *instantaneous gravity dump* . . . operator releases fast by-pass of fluid in hydraulic cylinders . . . gravity takes over . . . dumps load instantly. Or, operator can apply *controlled gravity dump.* Hydraulic system acts as a retarder. Gravity actually tilts the body . . . hydraulic pressure controls the rate of discharge.

in a BIG 10-YARD Koehring® Dumptor®...

. . with dual controls, pivoting seat, 20.8 mph speeds in both directions

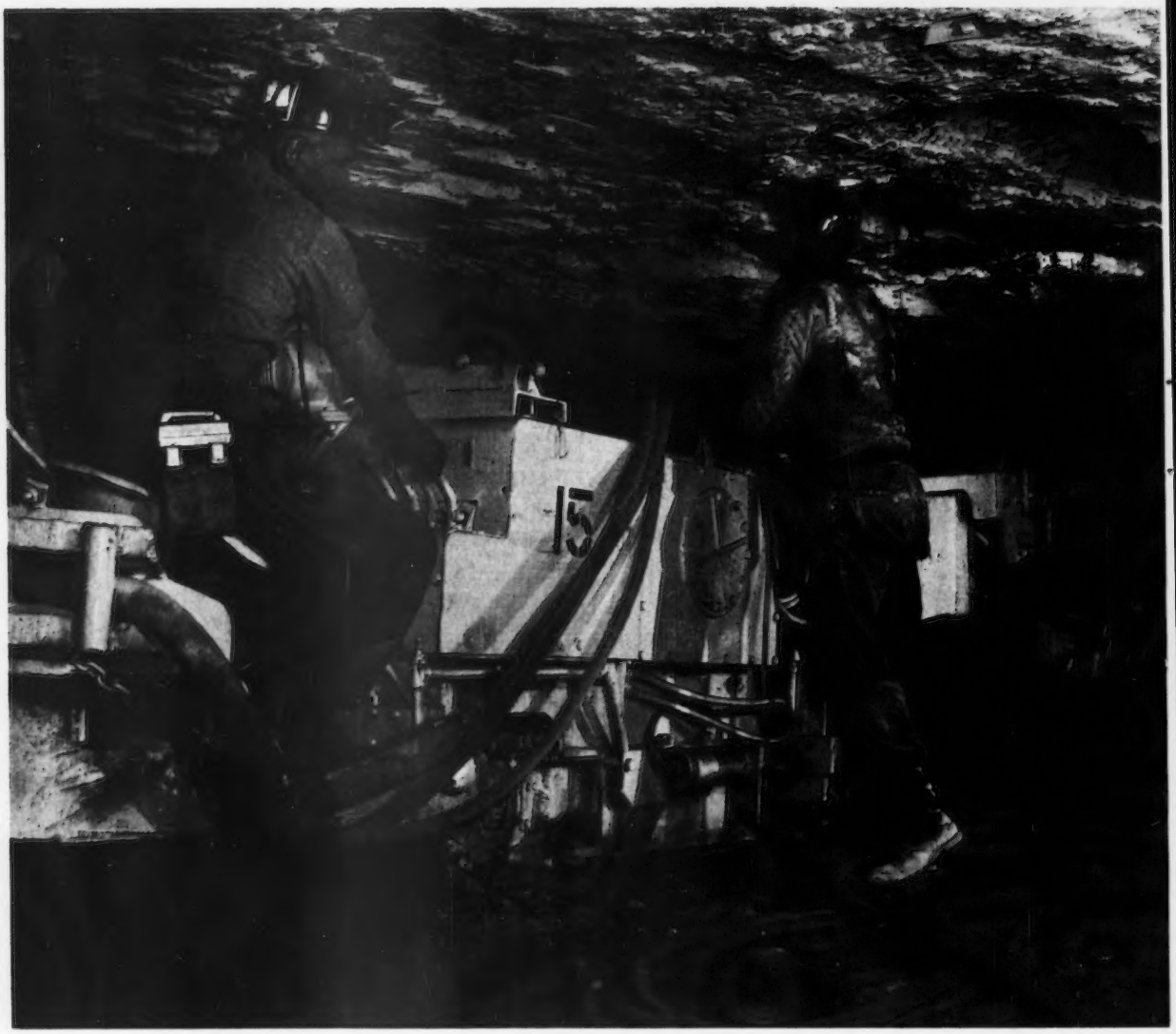
- **Two steering wheels, throttles, brake pedals . . . one each located at *both* operating positions of *pivoting* seat.**
- **Directional travel and speed-range lever, and dump controls, centrally-located for 2-way operation.**
- **Speed range selections up to 20.8 m.p.h. in either direction controlled by easy-acting hydraulic clutches.**
- **Constant-mesh transmission with smooth torque converter drive . . . hydraulic power steering.**
- **2 ways to dump — *instantaneous* gravity dump . . . or *controlled* gravity dump with hydraulic cylinders.**
- **30,000-lb. payload capacity . . . 28.5% gradability . . . big, safe, 4-wheel airbrakes, plus parking brake.**

See for yourself how this big 10-yard Dumptor, with its unique shuttle haul advantage, can profitably boost output in your open pit, or underground mine. Call your Koehring distributor for a demonstration . . . do it today!

KOEHRING
DIVISION OF KOEHRING COMPANY
Milwaukee 16, Wisconsin

2 SIZES — In addition to the new 10-yard, Koehring builds a smaller, companion model 6-yard Dumptor (above). It has a ton of strength for every ton of payload capacity . . . 6 H.P. for every ton of loaded weight . . . 3-speed travel in both directions . . . 1-second dump . . . many other cost-cuting advantages for heavy-duty off-road hauling. Put Koehring Dumptor on your work.

LOAD WITH KOEHRING — Get lowest costs on hauling, stripping, loading . . . team Dumptors with Koehring heavy-duty shovels. ½-yard 205 is shown above. Other sizes up to 3-yards . . . including high-lift stripping shovels. Fully convertible to clamshell, dragline, lift cranes. Also check sensational new Koehring Skooper — free-swinging, full-revolving, 2-yard loader.



Flexibility, toughness and resistance to abrasion, oils, acids, alkalies and mine water are designed and built into these **Tiger Brand Cables.**

Keeps machines on the job. Tiger Brand cables take constant dragging over mine floors and around sharp corners.

USS Tiger Brand Electrical Wire & Cable

A standard cable for every special job

- Asbestos Wire and Cable
- Mold-Cured Portable Cord
- Shovel & Dredge Cable
- Paper & Lead Cable
- Varnished Cambric Cable
- Interlocked Armor Cable
- Special Purpose Wire & Cable
- Aerial, Underground and Submarine Cable

What's the difference in electrical wire and cable?

Even though electrical cables may look alike and start with some of the same materials, there's a *real difference* in the completed cables.

The difference in USS Tiger Brand Amerclad Cables results from a combination of research, engineering and construction. The development of better materials goes on constantly at American Steel & Wire. Insulation and jacketing compounds have been improved.

Better stranding designs and methods of stranding add years to cable life.

Amerclad Cables are protected by an outer jacket of Amerprene, an oil-resistant compound containing a high percentage of Neoprene. Before being vulcanized, an Amerclad Cable is encased in a substantial lead sheath that is afterward removed. The pressure developed within this rigid mold during the vulcanization process produces a dense, non-porous jacket that is highly resistant to abrasive wear.

Knowledge of severe field conditions obtained through AS&W sales engineers permits designing for special conditions.

Constant effort to control quality and improved methods of inspection assure a product of highest quality.

These are a few of the unseen plus values you get when you buy Tiger Brand Cables for your shovels, continuous miners, drills, shuttle cars and other equipment. For complete technical information, write for our free book, "Tiger Brand Amerclad Cord and Cable." American Steel & Wire, Dept. 931, 614 Superior Avenue, N. W., Cleveland 13, Ohio.

USS, Amerclad and Tiger Brand are registered trademarks

American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad

How to Carry Air and Water ...Underground

Fresh air . . . water . . . air under pressure —whichever is your problem in mining operations, you can depend on NAYLOR pipe to handle it.

This light-wall pipe is easy to handle and install yet its spiral-lockseam provides extra strength against collapse, and safety for shock loads, stresses and strains. You save time and work in making up lines when you use the one-piece NAYLOR Wedgelock coupling. It speeds connections and makes coupling possible with only one side of the pipe in the open.

Write for Bulletin No. 59 to get the details.

NAYLOR PIPE *Company*

1243 East 92nd Street, Chicago 19, Illinois

Eastern U. S. and Foreign Sales Office: 60 East 42nd Street, New York 17, N. Y.

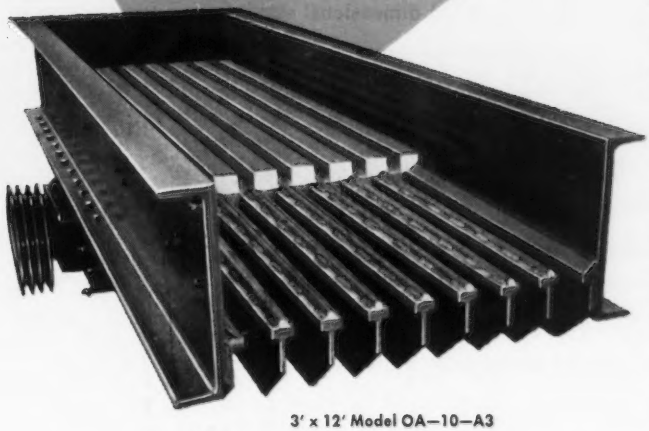
SIMPLICITY

GRIZZLY FEEDER

3' x 10' Model OA—10—A3

eliminates need of apron feeder and scalper . . .

Rock can't jam . . . hourly operating costs lowered



3' x 12' Model OA—10—A3

The unique design of the Simplicity Grizzly Feeder, which combines feeding and scalping in one operation, eliminates rock jams thus assuring positive uniform flow of material into the crusher.

One operator of a Simplicity Grizzly Feeder says: "... we have used the heaviest type of apron feeders for years and have found it necessary to shut down at least 2 or 3 times a year to hard surface the flights, inasmuch as our material is so abrasive ... we installed a Simplicity (Grizzly) Feeder ... with 1/4" pan and 3/16" liner ... and are glad to report that, AFTER 9 MONTHS OF CONTINUOUS OPERATION, THE FEEDER PAN SHOWS PRACTICALLY NO WEAR WHATSOEVER, and is operating around the clock doing an excellent job of feeding at all times ..."

The Grizzly Feeder costs less than 50% of the combined apron feeder and scalper ... weighs considerably less ... makes a more compact plant ... and reduces loading height by several feet. While these factors show up so prominently in portable plant production, they are just as effective in a permanent plant installation for the crushed stone, sand and gravel and mining industries.

214

Send for Catalog #571 for complete information on OS-A-VEYOR and GRIZZLY FEEDERS.

SALES REPRESENTATIVES IN ALL PARTS OF THE U. S. A.
FOR CANADA: Simplicity Materials Handling Limited, Guelph, Ontario
FOR EXPORT: Brown & Sites, 50 Church Street, New York 7, New York

Simplicity
TRADE MARK REGISTERED

ENGINEERING COMPANY • DURAND 4, MICHIGAN

CYANAMID

Explosives News

Four concentric layers of plastic insulate Cyanamid Blasting Cap Wires for maximum performance!

Vinyl plastic leg-wire insulation, applied by Cyanamid's unique continuous-bath method, offers superior uniformity . . . free of thin spots . . . and improved dimensional stability.

As a result, it combines these important advantages:

- Greater electrical insulation . . . with dielectric strength of 4,000-6,000 volts!
- High abrasion resistance!
- Improved flexibility . . . even at –40°F!
- Insulation values retained during prolonged high-temperature exposure!
- Inert to materials used in dynamite formulations!
- Non-porosity and greater moisture resistance!

Perfect concentricity is achieved by dipping the wire in four consecutive baths. Between baths, it passes through a series of dies which remove excess material and each coat is heat-cured. Imperfections which could occur in a single coating are eliminated in this multi-coat system.

For additional information about our complete line of electric blasting caps, write Cyanamid or consult our Field Engineer.

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

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Albuquerque, New Mexico
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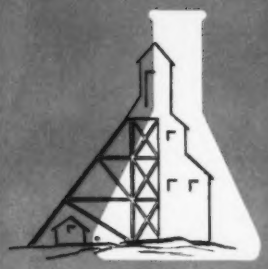
Permissibles
Seismograph Explosives
Blasting Agents
Blasting Caps
Electric Blasting Caps
Blasting Accessories

Cyanidation Process Chemicals
Flotation Reagents
Flocculating Agents
Film Forming Agents
Surface Active Agents



CYANAMID

REAGENT NEWS

"ore-dressing ideas you can use"

Five facts to remember when buying Cyanide

1. AERO® Brand Cyanide has been made, delivered and used for 40 years. Through two World Wars and countless local upheavals, no Cyanamid customer has ever had to curtail or shut down his mill operations for lack of AERO Brand Cyanide.

2. On the basis of NaCN equivalent, the metallurgical efficiency of AERO Brand Cyanide equals or exceeds that of any other grade of cyanide.

3. AERO Brand Cyanide has an inherent protective alkali content which usually reduces lime requirements.

4. AERO Brand Cyanide is clean, easy to handle and has been used for years with perfect satisfaction by small and large mills alike.

5. Our Field Engineers are always available to assist on metallurgical problems. They bring you the combined experience of a mature world-wide technical staff and the research resources of Cyanamid's Mineral Dressing Laboratory.

Our nearest office will be pleased to quote on your requirements for Cyanide and other reagents.

AMERICAN CYANAMID COMPANY

EXPLOSIVES AND MINING CHEMICALS DEPARTMENT

CYANAMID INTERNATIONAL — *Mining Chemicals Department*
Cable Address: — Cyanamid, New York

30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

CYANAMID OF CANADA LIMITED
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Bush House, Aldwych, London W. C. 2, England

SOUTH AFRICAN CYANAMID (PTY.) LTD.
P. O. Box 7852,
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E. P. CADWELL
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CYANAMID AUSTRALIA PTY. LTD.
"Collins Gate"
277 Little Collins Street
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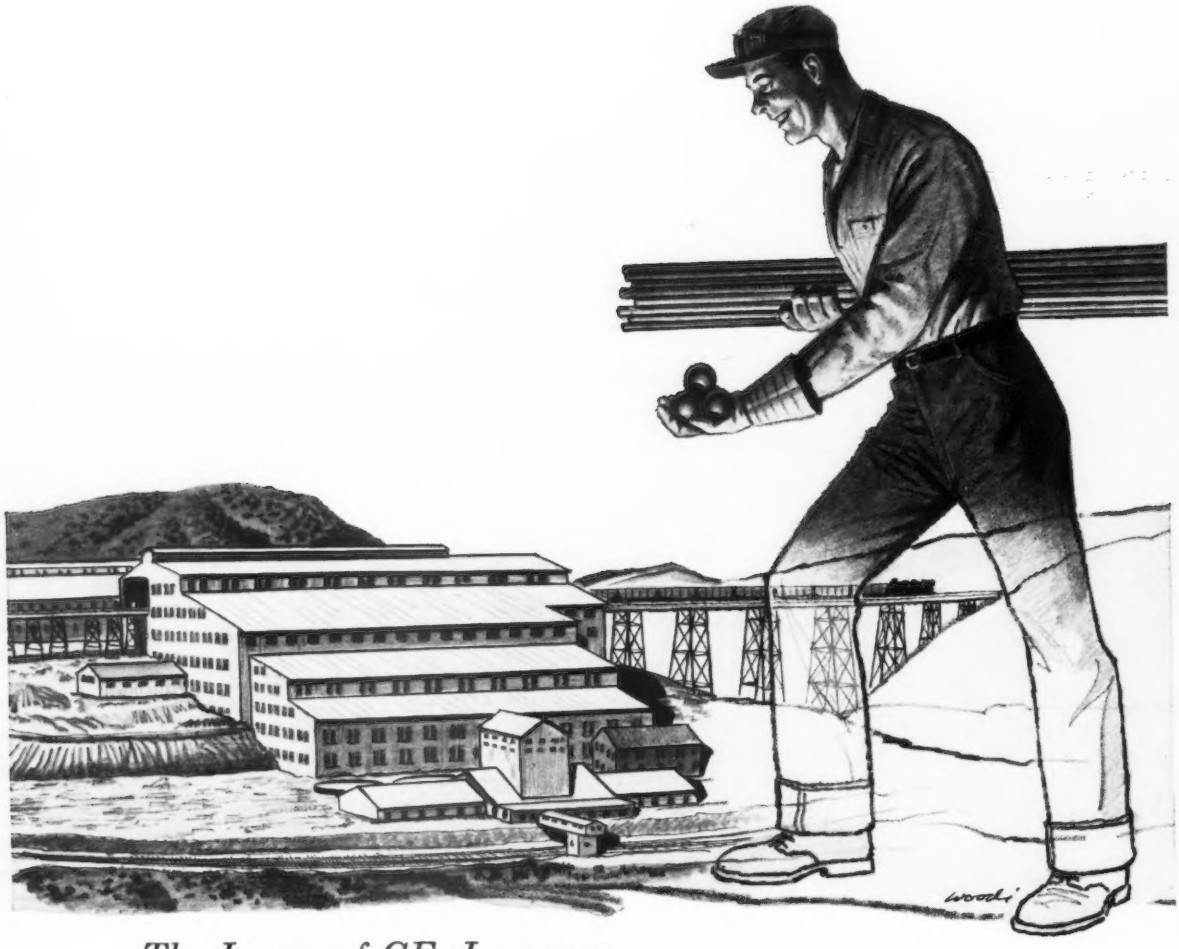
Cyanidation Process Chemicals
Flotation Reagents
Flocculating Agents
Film Forming Agents
Surface Active Agents

High Explosives
Permissibles
Seismograph Explosives
Blasting Agents
Blasting Powder
Blasting Caps
Electric Blasting Caps
Blasting Accessories



The Image of CF&I assures

quality steel Mining Products

This Image—the CF&I giant—stands for hundreds of dependable steel products used by many industries. And the CF&I name is prominent in the mining industry for such top-grade products as grinding balls and grinding rods.

For instance, the special analysis, hot-forged steel used in CF&I Grinding Balls gives uniform wearing qualities... high impact and abrasion resistance... maximum grinding efficiency.

CF&I Grinding Rods are hot-rolled from steel of special analysis, determined through years of experience to provide a hardness for high wear resistance, yet with a toughness to exclude bending or premature breakage. All rods are machine-straightened and their ends cut square so that they will freely rotate in the rod mill for better grinding.

We suggest you contact the nearest CF&I sales representative. He'll be glad to discuss your grinding problems with you, or give you complete information on all CF&I Mining Products.

OTHER CF&I STEEL PRODUCTS FOR THE MINING INDUSTRY

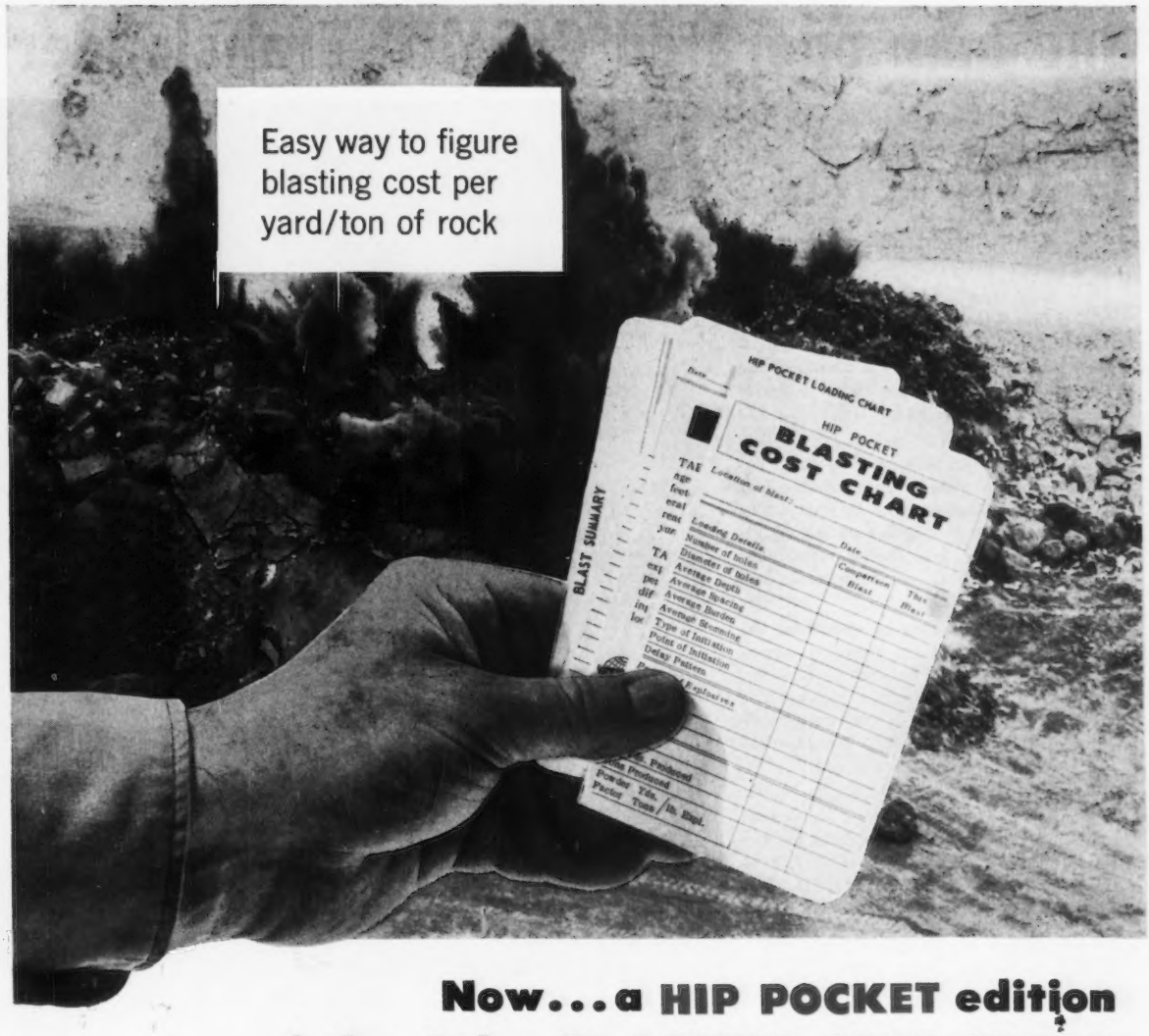
CF&I Grader Blades • CF&I Industrial Screens • CF&I Mine Rail and Accessories
CF&I-Wickwire Rope • CF&I Rock Bolts and Realock Metallic Fabric

CF&I STEEL

MINING PRODUCTS
THE COLORADO FUEL AND IRON CORPORATION

In the West: **THE COLORADO FUEL AND IRON CORPORATION**—Albuquerque · Amarillo · Billings · Boise · Butte · Denver · El Paso · Farmington · Ft. Worth · Houston · Kansas City · Lincoln · Los Angeles · Oakland · Oklahoma City · Phoenix · Portland · Pueblo · Salt Lake City · San Francisco · San Leandro · Seattle · Spokane · Wichita

In the East: **WICKWIRE SPENCER STEEL DIVISION**—Atlanta · Boston · Buffalo · Chicago · Detroit · New Orleans · New York · Philadelphia 6625


Easy way to figure blasting cost per yard/ton of rock
HIP POCKET LOADING CHART
HIP POCKET
BLASTING COST CHART
BLAST SUMMARY

Now...a HIP POCKET edition of the Atlas BLASTING COST CHART

Here's a new 1959 Atlas Blasting Cost Chart that goes right out on the job with you—helps you record the cost data you need to protect your profits.

The original Blasting Cost Chart, with instruction book and Slide Rule, is being used successfully by hundreds of operators. Now, to make it more convenient, Atlas has added this "hip-pocket" edition. With it you can compare results from blast to blast to determine methods that pay off best. It helps you assemble quick cost facts on drilling, secondary breakage, digging, hauling, and crushing.

Your Atlas representative will be glad to show you how to use the new "hip-pocket" Cost Chart. He has a kit full of information that may help reduce your costs and protect your profits. Ask him for details, or write us direct.

EXPLOSIVES DIVISION
ATLAS
POWDER COMPANY
WILMINGTON 99, DELAWARE
Offices in principal cities

Ask your Atlas representative to show you the electric match demonstration . . . See why Atlas E. B. Caps lead the field in dependable performance.

One man operated GISMO® Transloader

- . . . with round-trip travel 1,600 feet
- On shorter hauls tonnage ranges up to 2-tons a minute.
- On longer hauls, tonnage ranges down to 1-ton a minute.

This HIGH tonnage production is accomplished by:

One Man
One S-D Gismo Transloader

How can one man and one piece of equipment do so much work? Because the Sanford-Day Gismo Transloader is BOTH a mucking-machine and a truck ALL-IN-ONE!

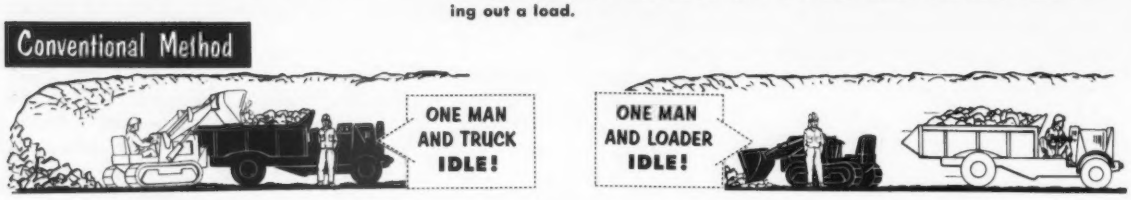
It is a high-speed transport — up to 20-miles per hour either direction! The fact it self-loads enables you to completely eliminate idle time of both men and equipment! Therefore, less capital investment required for additional equipment and manpower to do the job.

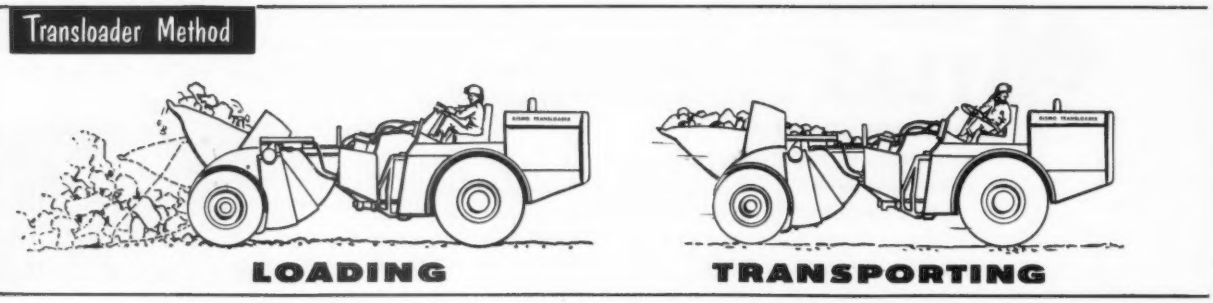
In conventional loading of materials, the loader is dependent on auxiliary equipment such as truck or shuttle car, etc. The loader cannot operate without the auxiliary conveyance. Neither does the haulage system operate while being loaded. Thus idling of men and equipment.

Compare this with the S-D Gismo Transloader. When Transloader is operating, man and equipment are working all the time; either mucking or transporting to dumping point! NEITHER THE TRANSLOADER NOR ITS OPERATOR ARE EVER IDLE! They are continuously at work in uninterrupted cycles!

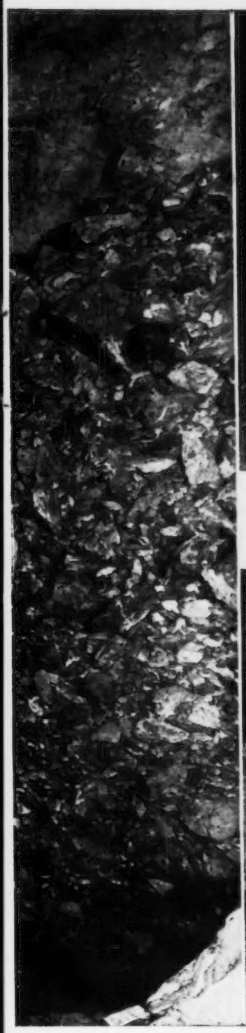
Visualize one or several S-D Gismo Transloaders, each with only one man, MUCKING AND HAULING in your development or production work. Savings are tremendous! Write or call us today. *Manufactured by Sanford-Day Iron Works, Inc., Knoxville, Tenn.*

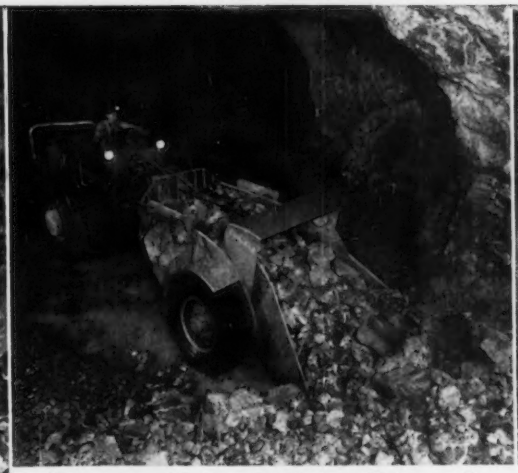
This photograph catches the action of the S-D Gismo Transloader mucking out a load.





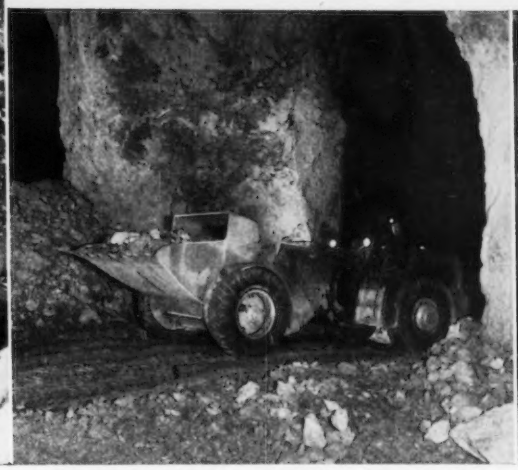
"Mucks-Hauls-Dumps" 100-tons an hour!





Here you see S-D Gismo Transloader with large, wide dipper down under hard rock. Transloader makes its own roadways and cleans-up completely . . . also moves large boulders for secondary blasting.

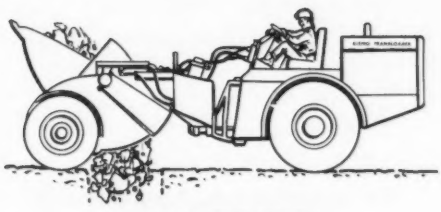
. . . and here is dipper raised with full load. This high-powered, high-speed Transloader operates on grades, in favor or against the load . . . negotiates, turns, etc.



This tramming scene (on way to raise) shows S-D Gismo Transloader as truck-transport.

Here load is being dumped into raise. Transloader also backfills waste, or dumps directly into bin . . . or by simple ramps over trucks, cars, conveyors, etc.

THE GISMO TRANSLOADER, rubber-tired Gismo Self-Loading Transport, is an advanced equipment development that is a perfectly natural result of the performance of the Gismo powered by crawler-mounted tractors developed a few years ago and doing an outstanding job in mechanized mining today!



DUMPING

SANFORD-DAY

KNOXVILLE, TENNESSEE

- S-D Mine Cars, all types and kinds.
- Precision S-D Mine Wheels.
- Tough, year-after-year wheel service by special S-D wheel Hard-Facing Process (this can really save you money and eliminate downtime).
- S-D "Brownie" Hoists. • S-D Car Spotters.
- S-D Mine Sheaves and Rollers.
- S-D Slusher-Trains for mining and construction industries.
- S-D Gismo Transloader for mining and construction industries.

ROEBLING 2 AWG
Sheath is tough, oil- and moisture-resistant, flame-retardant Roeprene.
Sheath surrounds and grips serrated conductor insulation ...conductors are locked fast, can't "sleeve."
Ground conductor has braided green cotton covering. It strips clean for easy terminating, splicing.
GR-S insulation around each power conductor is heat- and moisture-resistant.
Ground conductor is braided and eased into shape from fine annealed copper wire for outstanding resistance to flexing fatigue and tensile stress.

For the **extra life** that's **money** in your pocket...

ROEBLING PARALLEL TWIN CABLE!

This economical, extra-flexible cable is available as Type G, with ground wire, or Type W, without. Complies with the flame resistance test of the State of Pennsylvania, Department of Mines, and the requirements of the U. S. Bureau of Mines, and carries the marking P-111BM.

A combination of quality features makes Roeprene® Parallel Twin Mining Machine Cable different and better. Some of these features may seem like small details . . . but, taken together, they figure *big* in terms of easier installation and maintenance, and valuable *extra* service life. Flexible Roeprene Parallel Twin Cable is built to take tough treatment!

For more details about these cables, and the savings they mean, write Electrical Wire Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

Branch Offices in Principal Cities
Subsidiary of The Colorado Fuel and Iron Corporation

A longer-lasting REVERSIBLE cap and adapter...

Try this on- for SAVINGS!

Service-proved WEARPACT Cap Type Tooth —with foolproof retainer—cuts digging costs to record lows . . . even in taconite!

Probably by now you've heard of Wearpact Steel—the alloy with a combination of hardness and toughness not available in any other commonly used alloy.

Here's a new tooth and adapter design* cast in longer-wearing Wearpact . . . the ASF Cap Type Tooth and adapter that's reversible for longer life. Note that the tooth itself is self-sharpening. Keeps on *slicing* through the ore and overburden—and when finally worn, there's less metal to throw away. *The tooth locks securely to the adapter.* No ASF retainer has ever failed in service.

As for service life, the cost-per-ton figures in large mines speak for themselves. Lowest of any tooth on record! Give this dollar-saving tooth a try! Write today to arrange for an installation.

Cut your costs with WEARPACT

CAST ALLOY STEEL

A PRODUCT OF

AMERICAN STEEL FOUNDRIES

3800 Canal St., Indiana Harbor, Indiana

*Patent Pending.

New 19 and 27

- 375 and 250 hp engines
- 30% less body weight
- 14% faster haul speeds

NEW "95" Payhauler

STRUCK: 18 cu. yd. PAYLOAD: 27 tons

The new Model "95" Payhauler moves payloads faster and for less money than any 27-ton rear dump with cycle-speeding 375 hp under the hood and elimination of all free-loading body weight.

Here's why the new "95" earns more for you:

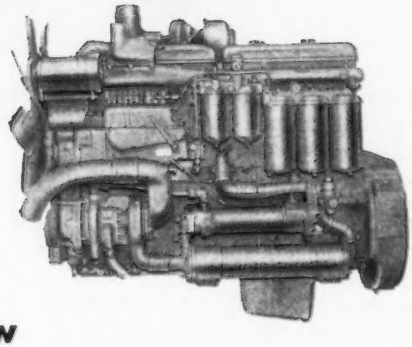
New 375 hp turbo-charged International diesel engine plus rugged yet tons-lighter corrugated body gives best power-to-weight ratio of all similar rigs, helps move payloads 14% faster on all grades both up and down.

Speeds to match all loads and roads with choice of torque-converter with powershift, or 9-speed, constant-mesh transmission. Haul speeds to 38 mph.

Faster reversing, up to 7.1 mph with gear-drive model speeds spotting or positioning for dumping.

Load-speeding safety and unequalled operating ease with power steering, torqmatic braking, and full-sweep vision.

11-second dumping with exclusive inverted hoist action and industry-topping snubber mechanism.



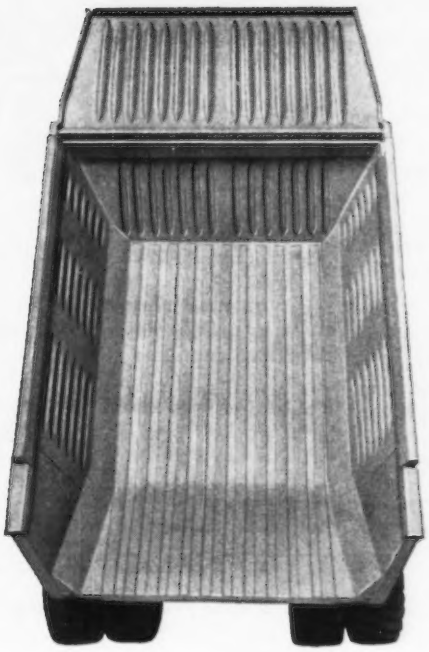
Great new 375 hp and 250 engines

Both Payhauler models have a big power plus under the hood. The "95" is powered by this all-new International DT-817 375 hp turbo-charged diesel while the "65" is powered by the same basic engine, the naturally aspirated D-817, that develops 250 dependable low cost hp. Both are heavy-duty, high-speed, direct-start, 4-cycle, 6-cylinder models thoroughly proved in six years of development and testing. Both are products of 26 years of International experience building heavy-duty diesels for rugged applications.

— ton Payhauler® models

NEW "65" Payhauler **STRUCK: 12.5 cu. yd.** **PAYLOAD: 19 tons**

The new Model "65" Payhauler sets new performance standards as the only 19-ton off-highway truck on the market...new 250 hp naturally aspirated International diesel engine...best power-to-weight ratio...new rock-ribbed body with tons less deadweight...10-speed constant-mesh transmission that helps bonus power speed more paydirt...speeds to 36.37 mph...and cab comfort and safety features that let the operator keep his mind on his work rather than on truck controls. For a refreshing experience in what's new in rear dumps, invite your International Construction Equipment Distributor to bring either Payhauler to your job for a showdown demonstration against your present haulers.



Biggest body improvement in 25 years

International corrugated quarry and standard bodies are the industry's biggest body improvement in 25 years. Corrugated panels—with triple the strength of conventional flat steel plates—cut body weight 30% in sides, front, canopy, and subfloor at no reduction in strength or protection to operators. Loads being dropped onto the body wear floor are cushioned by up to 26 corrugations in the sub-floor. Patent applied for heated bodies have no cold spots, create no damaging exhaust back pressure. Benefit: haul payloads without hauling up to 5000 pounds of free-loading steel each cycle.

International® *Construction Equipment*

International Harvester Co., 180 North Michigan Avenue

A COMPLETE POWER PACKAGE: Crawler and Wheel Tractors . . . Self-Propelled Scrapers and Bottom Dump Wagons . . . Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

Huge fan makes mine its own air conditioner!

Stainless steel prevents failure of fan blades in damp corrosive atmosphere

Warms air in winter! Cools air in summer!

That's how the system diagramed at the right improves working conditions in Inco-Canada's big Frood-Stobie mine.

In winter, the fan drives frigid outside air through sprayed water in two tremendous stopes at the 300- and 500-foot levels. The water freezes... gives up its heat to warm the air.

In the summer, the fan drives warm outside air over the glacier-like accumulation of ice formed during the winter. As the ice melts, it extracts heat from the air. Miners work in comfort year 'round.

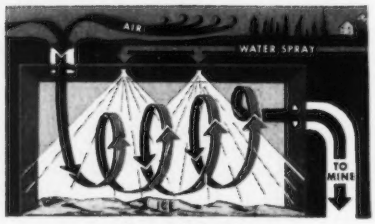
It's all done with one 750,000 cu. ft./min. fan.

This big, 16½-foot fan operates continuously day-in, day-out in all weather. And that outside air it handles contains dust and traces of corrosive sulphur dioxide.

To meet these conditions the 12 blades of this fan are stainless steel.

Stainless steel insures long blade life

Nickel-containing stainless steel has the resistance to corrosion, erosion and fatigue called for in mine and mine building air-conditioning systems and in other mine applications. It gives you extra strength and toughness, too. And it's easy to fabricate.



How it works

Consider stainless steel when you need long, reliable equipment performance and extra strength.

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

INCO NICKEL

NICKEL ALLOYS PERFORM BETTER, LONGER

product:

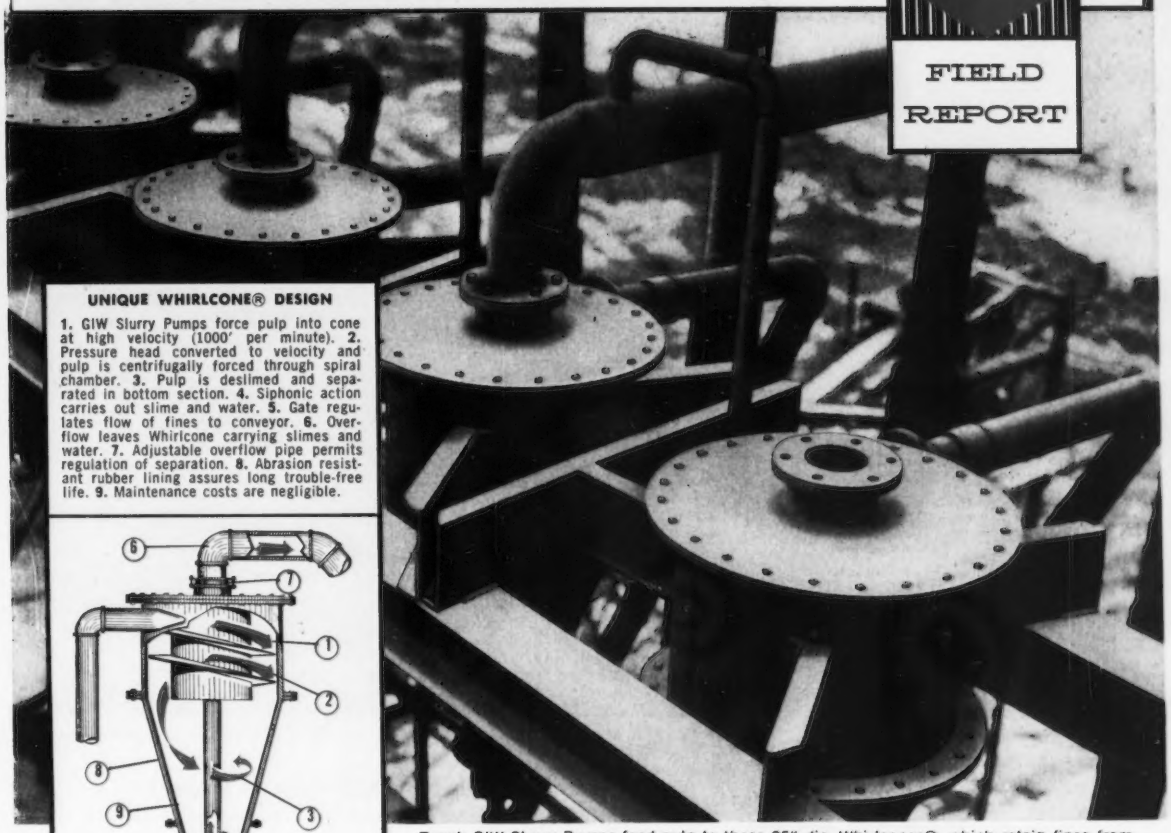
COTTRELL WHIRLCONE® SEPARATORS

customer:

BECKER COUNTY SAND & GRAVEL CO.

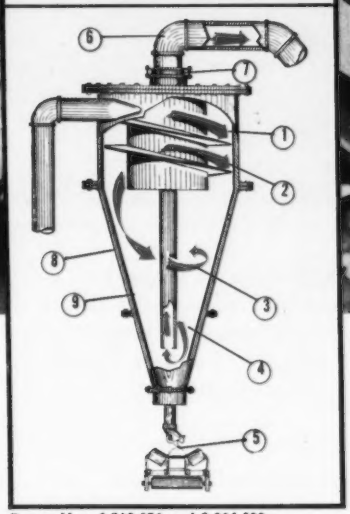
GIW

FIELD REPORT



UNIQUE WHIRLCONE® DESIGN

1. GIW Slurry Pumps force pulp into cone at high velocity (1000′ per minute). **2.** Pressure head converted to velocity and pulp is centrifugally forced through spiral chamber. **3.** Pulp is deslimed and separated in bottom section. **4.** Siphonic action carries out slime and water. **5.** Gate regulates flow of fines to conveyor. **6.** Overflow leaves Whirlcone carrying slimes and water. **7.** Adjustable overflow pipe permits regulation of separation. **8.** Abrasion resistant rubber lining assures long trouble-free life. **9.** Maintenance costs are negligible.



Patent Nos. 2,738,070 and 2,806,599

Tough GIW Slurry Pumps feed pulp to these 25" dia. Whirlcones®, which retain fines from classifier overflow. Maximum recovery rate is 20 tons per hour per cyclone. The cones will handle material from −12 mesh to lightest slime.

Whirlcone® Separators solve difficult fine recovery problems.

The retention of fines in the −50 plus 200 mesh range posed a disturbing problem for the Becker County Sand & Gravel Co., of Cheraw, S.C., primarily because the large amount of water used in processing the sand and gravel washed out the desirable fines with the minus 200 slimes.

Fourteen 25" dia. Whirlcone® wet type cyclones installed parallel in four Becker plants solved this problem completely. Operating an average of 8 hours daily, they extract up to 100 tons of clean, fine sand per hour from wash water while the minus 200 mesh slime is discarded.

Recovered fines are used to bring sand up to specifications. Thousands of tons of valuable sand, formerly lost, soon paid for the low cost of the Whirlcones®.

GIW's highly efficient Whirlcones® are also being used in the mining fields to deslime, degrit, classify, concentrate, make dam and mine backfill and to dewater or thicken where the overflow can be returned to the process or it can be discarded.

They are available in diameters from 6" to 50". Capital cost including the pump is 20 to 50% of conventional classifiers.

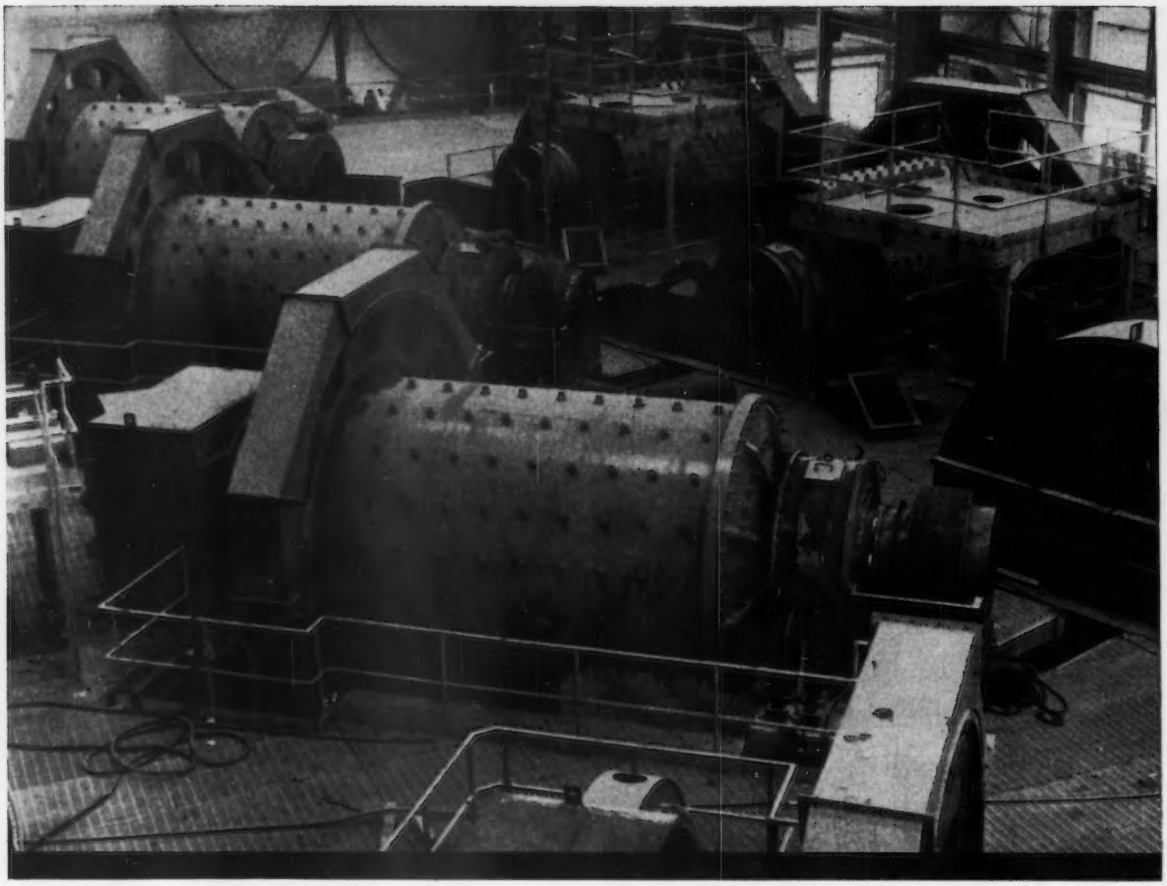
If you are losing fines from material −12 mesh to lightest slimes, write today. Recommendations and literature will be forwarded promptly.

COTTRELL ENGINEERING
Division of
GEORGIA IRON WORKS CO.

GIW

Manufacturers of pumps, dredges, separators and accessories.

AUGUSTA • GEORGIA



for tough grinding problems KENNEDY Ball and Rod Mills

KENNEDY Ball and Rod Mills solve the toughest grinding problems by providing dependable wet or dry grinding at low cost and with minimum maintenance. Consult KENNEDY and learn more about these features that distinguish KENNEDY Grinding Mills:

- Cast steel or Meehanite heads
- Welded and stress-relieved heavy steel plate shells
- Large diameter trunnions
- Self-aligning bearings with adjustable sole plates
- Positive "Ferris Wheel" lubrication of main bearings
- Oil-tight bearing seals
- Motorized hydraulic lift to reduce starting torque
- Single helical cast steel gear and pinion

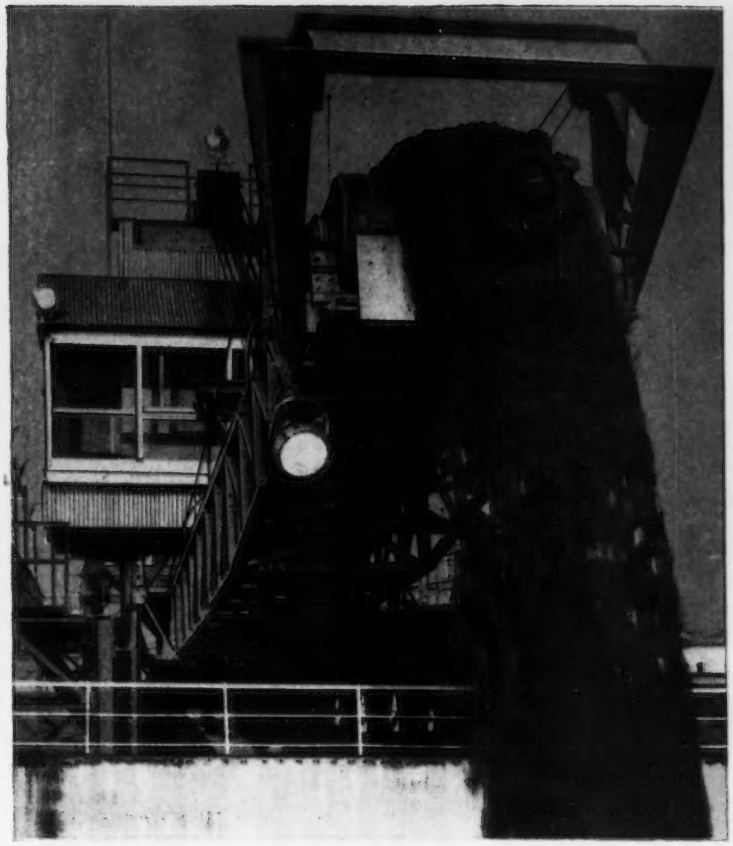
KENNEDY VAN SAUN

MANUFACTURING & ENGINEERING CORPORATION

405 PARK AVENUE, NEW YORK 22, N.Y. • FACTORY: DANVILLE, PA.

Primary & Secondary Gyratory Crushers • Jaw Crushers • Roll Crushers • Impact Breakers • Hammer Mills • Rod & Ball Mills • Kilns Dryers • Screens • Conveyors • Complete Crushing, Lime and Cement Plants. KENNEDY Research & Testing Services.

STEPHENS-ADAMSON



Giant S-A AMSCO Feeder

S-A Stockpiling Conveyor System

S-A Twin Shiploading System

FOR EFFICIENT, PROFITABLE ORE HANDLING

At the left, ore is shown pouring into a ship's hold at an average rate of more than 4,000 long tons per hour from one of two giant STEPHENS-ADAMSON boom conveyors at Sept. Iles, Quebec. The STEPHENS-ADAMSON equipped ship-loading facilities believed to be the largest capacity in the world — handles as many as seven ore vessels a day and nearly 10,000,000 tons of ore a year.

STEPHENS-ADAMSON is proud to have been selected to equip the ship-loading facilities and other ore handling operations of the huge Quebec-Labrador project — one of the most far-reaching construction projects ever undertaken.

Write for Literature on S-A Ore Handling Equipment.

S-A

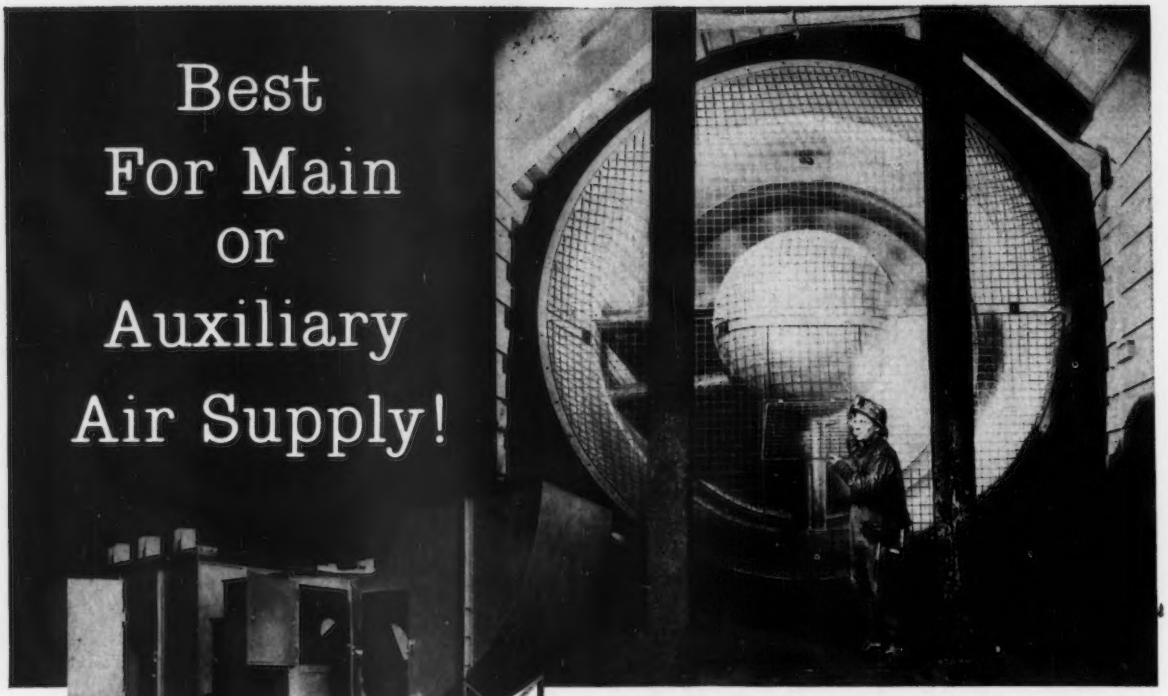
ENGINEERING DIVISION

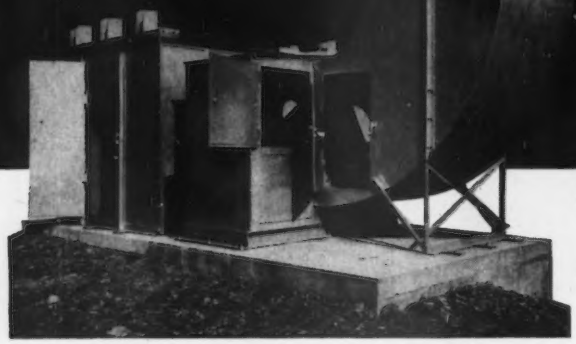
STEPHENS-ADAMSON MFG. CO.

GENERAL OFFICE & MAIN PLANT, 4 RIDGEWAY AVENUE, AURORA, ILLINOIS

PLANTS LOCATED IN: LOS ANGELES, CALIFORNIA • CLARKSDALE, MISSISSIPPI
BELLEVILLE, ONTARIO

Best For Main or Auxiliary Air Supply!





Above: 9′ Joy Axivane Mine Fan teams with an 8′ Joy Fan to provide main ventilation system for Climax Molybdenum Company mine.

Left: 10 H.P. V-belt drive Joy Axivane Fan moves 50,000 feet of air each minute. Ideal for auxiliary or small-mine ventilating duty. Photograph courtesy U.S. Bureau of Mines.

JOY AXIVANE MINE FANS

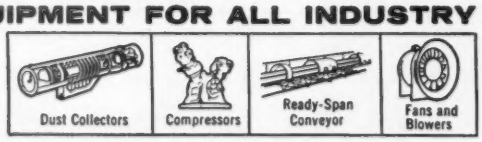
MAIN AIR SUPPLY Low operating speed, wide operating range, simultaneous . . . and easy . . . blade adjustment, and ready bearing accessibility assure you efficient, dependable ventilation for your mine. The big 9′ Joy Axivane Fan illustrated at top right is in operation at Climax Molybdenum Company's mine in Climax, Colorado. This V-belt driven fan produces air volumes from 81,000 CFM to 770,000 CFM, and above, with pressures up to 15″ w.g. It teams with an 8′ Joy Fan to furnish the main air supply for the Climax mine.

AUXILIARY AIR SUPPLY The 10 H.P. V-belt drive Joy Axivane Fan, illustrated at top left, moves 50,000 feet of air each minute with total pressure of .75 inches. Fitted with reversible motor, this efficient air-moving machine is ready to exhaust stale air or draw in fresh air for the working crews. Remote-controlled adjustable blades allow you precise control of air volume and pressure. It is designed for auxiliary ventilation service in a large mine or for primary ventilation in a small mine.

The vaneaxial design of Joy Mine Fans conforms to the latest formulae of aerodynamics . . . to give you increased efficiency and greater power savings. Joy Axivane Mine Fans are available in sizes up to 12′ in diameter, with air volumes up to 1,120,000 CFM.

Write for free Bulletin 56-4

AIR MOVING EQUIPMENT FOR ALL INDUSTRY

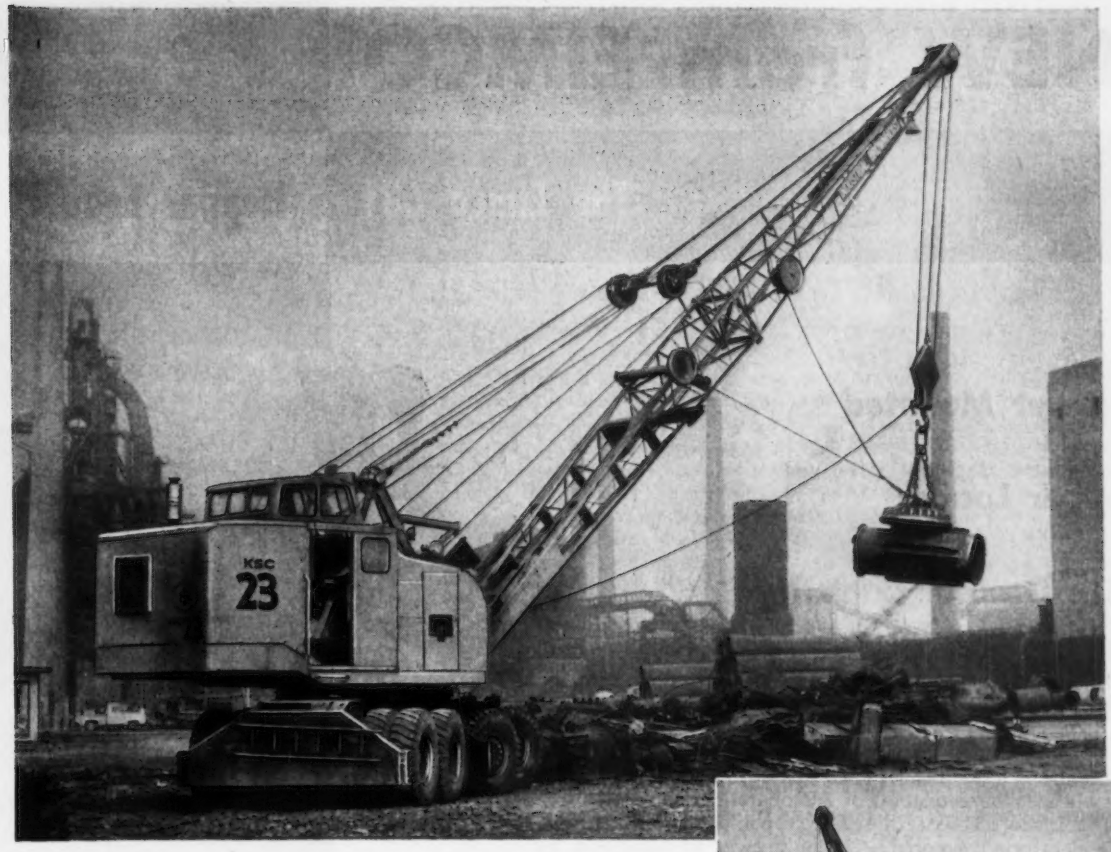


JOY

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario

WSW CL8967-56



ALL PARTS ARE INTERCHANGEABLE on Brownhoist's Diesel Electric Locomotive and Wagon Cranes

The 50 Ton Diesel Electric Wagon Crane and the 50 Ton Diesel Electric Locomotive Crane pictured here are two of several Industrial Brownhoist heavy-duty cranes operated by Kaiser Steel Co. at their huge plant in Fontana, California. Although these cranes operate at peak efficiency on a variety of rugged, daily jobs, it sometimes becomes necessary to replace parts. With Industrial Brownhoist cranes, either locomotive or wagon, part replacement is both swift and economical for every part is *interchangeable* from the car body up. The number of parts in your stock can be cut in half and down time for part replacement can be virtually eliminated.

If you need both a wagon crane and a locomotive crane for the heavy-duty jobs around your plant, get Industrial Brownhoist cranes. You, too, will benefit from the interchangeability of parts and such high performance features as exclusive 360-degree monitor-type cab, clear-vision boom, straight line power train and electric rotation for fast operation. Write for further information today.

208

BROWNHOIST

CLAMSHELL BUCKET

250 TON WRECKING CRANE

COAL-ORE BRIDGE

CAR DUMPER

LOCOMOTIVE CRANE

INDUSTRIAL BROWNHOIST CORPORATION • BAY CITY, MICHIGAN • DISTRICT OFFICES: Cleveland, Philadelphia, Chicago, San Francisco, Montreal.
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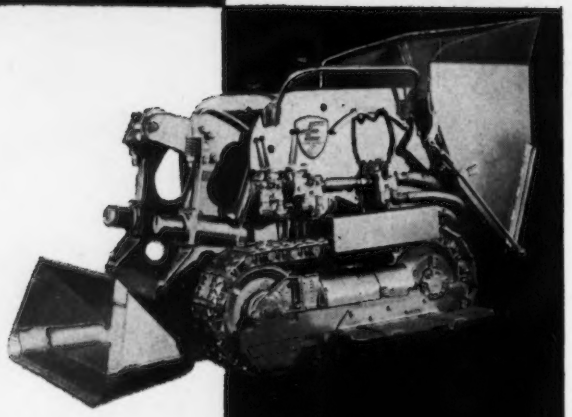
NEW from EIMCO

The Eimco 631 Hopper Loader



Crawler Mounted

Hopper Loader

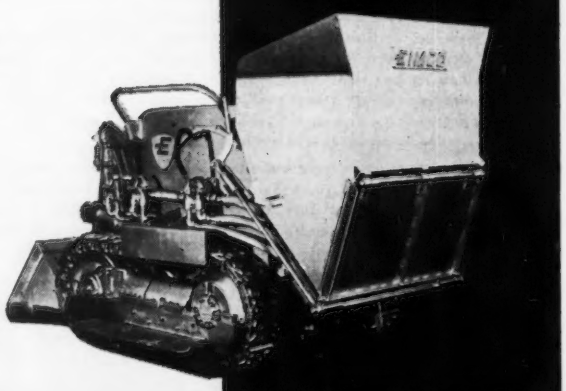
with Greater Capacity

Latest addition to the famous 630 series of compressed air activated, crawler mounted equipment, with a greater hopper capacity of 45 cubic feet. With an additional 5 cubic feet carried in the bucket, a payload of three tons (50 cubic feet), can be easily handled. The 631 will also be available for AC operation.

The Eimco 631 is self-loading, capable of both loading and carrying material. It is the answer to many and varied problems of developing and production-loading in stopes, drawpoints and other such areas.

Features include special long tracks for maximum stability and ground contact area; a positive semi-automatic hold-device, for holding loaded bucket in carrying position; heavy-duty and removable hopper with full opening door; improved, heavier equalizer bar; new, improved trunnions and brackets and additional track rollers for a crawler base capable of easily carrying these heavier loads.

Contact the nearest sales office or write The Eimco Corporation, P.O. Box 300, Salt Lake City 10, Utah, for all details.



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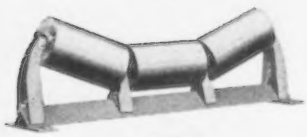

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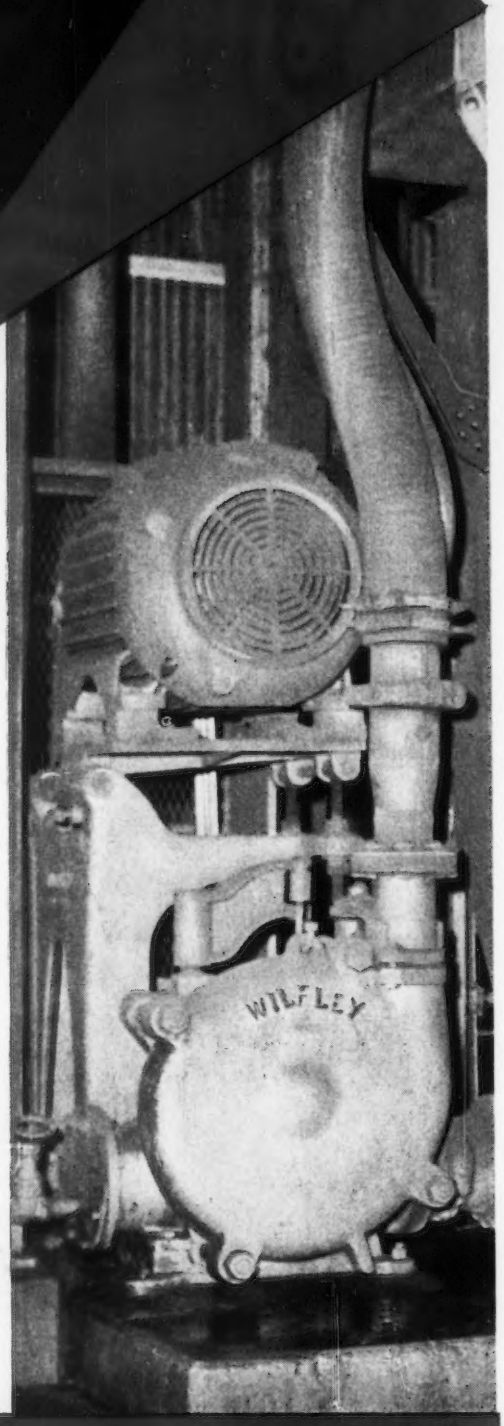
HMS CYCLONES
FED BY
WILFLEY
SAND PUMPS



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ENGINEERING AND MINING JOURNAL

MAY 1959

Mining's Next Frontier—Down

NOW THAT THE U.S. has been explored and settled from coast to coast and from border to border, it would appear that the nation no longer has frontiers to challenge future generations. Except for certain islands of inaccessible terrain such as the Primitive Area of Idaho, and arid expanses in the West, the frontiers which attracted the pioneers and prospectors of yesteryear have largely disappeared—that is, if we regard a frontier as a two-dimensional area.

But actually, a three-dimensional frontier does exist in the U.S. Geologists have called attention repeatedly to vast buried mountain ranges, intrusives and potential mineral-bearing formations which still await exploration at depth. Thus we still have a frontier, and that frontier is down!

Attractive as this new frontier may be, the probing of it will be impeded, or even discouraged, unless continuing efforts are made to clear up the vagaries that exist in state and federal mining laws. A number of legal disputes that arose during the recent uranium boom show the need for a clear-cut answer to this question: "What constitutes a valid discovery?"

A Utah court decision said, "We deem it entirely legitimate to rely on such indications [Geiger counter, scintillator or other radiometric readings] as one means of locating uranium." A Wyoming court decision refused to recognize a radiation counter reading as evidence of a valid discovery without supporting chemical assays. In Colorado a court held that the discovery of uranium by Geiger counter, later verified by chemical assay on one claim, justified the location of contiguous claims where radiometric assays were noted, but no chemical verification of samples had been made.

To compound this confusion, it might be added that a few mining states recognize the validity of diamond drill or rotary drill cores or cuttings as valid discoveries, or as an acceptable form of annual labor or assessment work. Others fail to recognize the usefulness of the diamond or rotary drill as modern exploration tools, despite the fact that many extensive uranium deposits were discovered with such equipment.

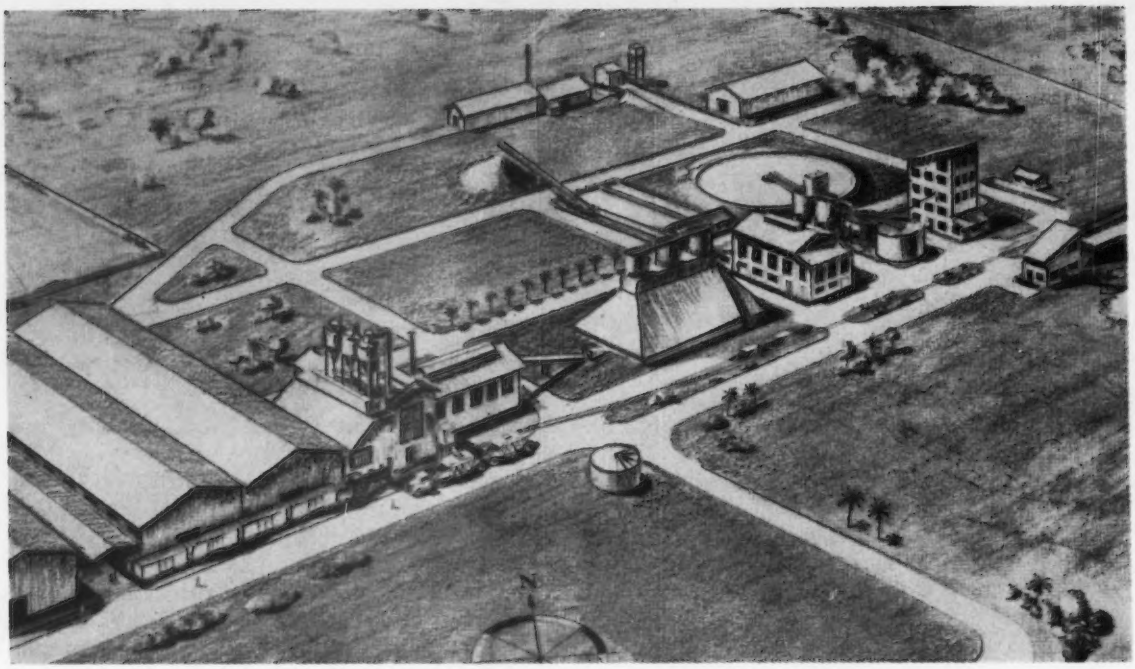
Federal Public Law 876, approved Sept. 2, 1958, provides that geological, geochemical and geophysical surveys, subject to certain limitations, may be used for the fulfillment of annual labor assessment requirements. But no state or Federal laws provide protection against claim jumpers while an exploration crew is undertaking costly drilling or geophysical work, or until such time that indications of the exploration can be proved up. Foreign nations offer concessions to exploration parties, and this, in part, may account for the fact that many domestic companies are participating in foreign ventures.

Legal requirements for locating, staking, recording, proving up and holding a claim which may be specified by state laws vary all over the lot.

If our remaining frontier is to be exploited by deep-level exploration and development, it is obvious that the cloudy areas of mining law outlined in the foregoing paragraphs will require attention soon. A future Western Governor's Conference, such as those held in recent years to develop mineral resources, might profitably devote its efforts to unifying the state mining laws pertaining to these aspects of exploration:

1. Define a valid discovery in light of the modern exploration and geophysical tools in use.
2. Specify how a claim is to be located, staked, recorded and proved up.
3. Define the types of work on a claim that will or will not be recognized as valid assessment work.
4. Include provisions to protect a prospector who is exploring at depth—where the lode-claim provisions simply do not apply.
5. Develop a system of plotting claims on district or county maps so that future prospectors will be able to tell which areas are still open to exploration.

The proposed Governor's Conference could examine the mining laws of each state and incorporate the best ones in a unified code—with special emphasis on those provisions which will channel exploration toward our remaining frontier—down.



INITIAL CAPACITY of Fosforita Olinda beneficiation plant is 250,000 tons per year. Current expansion plans will enable company to double capacity. Flow of material is from receiving plant, at right, to storage buildings, left.

How Fosforita Olinda S/A

W. H. EVANS

IN LATE MAY 1957, Fosforita Olinda S/A, started up their 250,000 tpy phosphate beneficiation plant near Recife, Pernambuco, Brazil. The plant produces two grades of phosphate by flotation; the high grade, 35% P_2O_5 (76.3% B.P.L. — bone phosphate of lime), and a secondary low grade product, used locally as a fertilizer, which is produced and contains 25% P_2O_5 (54.5% B.P.L.).

Mineralogically, the Olinda phosphate is collophanite as a fossil replacement in a gangue of quartz and feldspar sand grains and illite clay. Small amounts of dolomite, calcite and iron oxide and occasional grains of ilmenite, tourmaline and glauconite are present.

Processing of the Brazliian phosphate, while similar to the Florida phosphates, differs due to the grain structure and the percentages of phosphate contained in the slimes or finer fraction. Generally speaking the coarser than 28 mesh phosphate at Olinda is lighter than the silica, at finer than 28 mesh the silica is lighter than the phosphate. In Florida this is usually reversed. At Fosforita Olinda, approximately two-fifths of the total phosphate is contained in the minus 200-mesh material and half of that is the scrubber slimes. A separation is made at 325-mesh at Fosforita-Olinda with the minus 325 going to waste. In Florida, the usual plant practice is to waste the 150 or 200-mesh material.

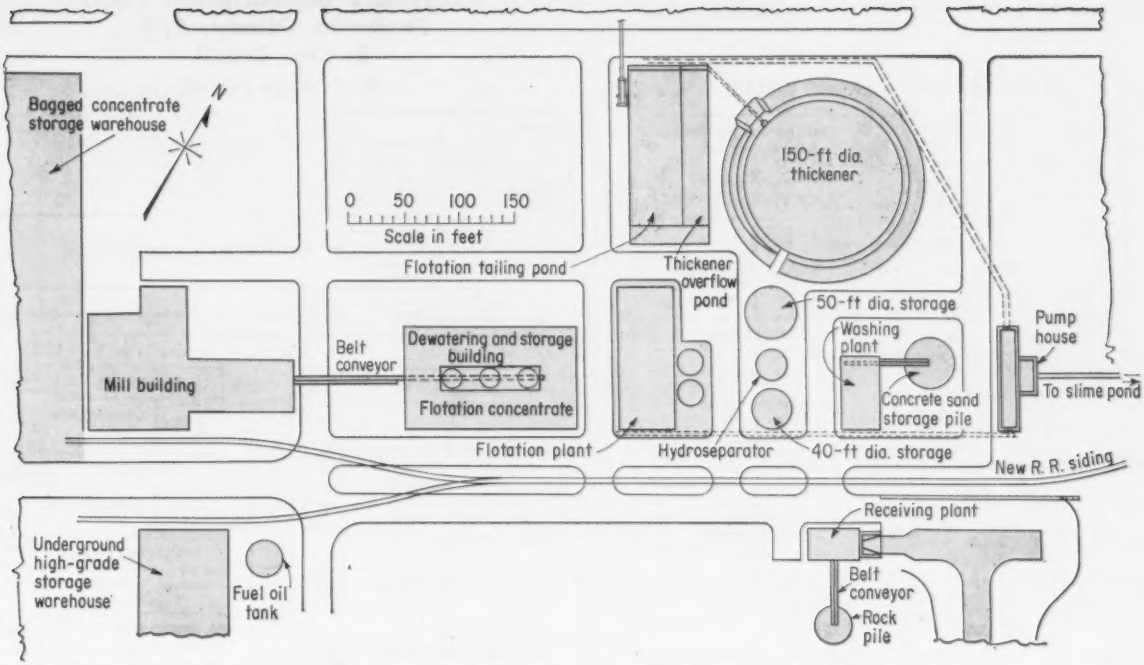
Mr. Evans is project engineer for Western-Knapp Engineering Co., New York, N.Y.

Four Draglines Mine Ore

The phosphate matrix is mined from an open pit near the plant. Four draglines are used to mine and load out Westinghouse—Le Tourneau Turnarockers and DW-15 Caterpillars which haul to the receiving plant or to the stockpile area adjacent to the plant. Feed is slurried with hydraulic monitors similar to the practice in the Florida phosphate plants. During the annual rainy season it is not feasible to operate the pit, and ground storage at the receiving plant is maintained to allow production during the two to three-month wet period. Stockpiled matrix is reclaimed with the clamshell and Turnarocker trucks.

The matrix is received in a dump hopper and hand washed with two pivoted monitors into a 5x12-ft double deck Allis-Chalmers Lo-Head vibrating screen. Reclaimed water (1600 gpm at 70 psi) is available for washing the matrix onto the scalping screen. The top deck has 2½-in. openings and the bottom deck ½-in. openings. Oversize from the screen drops to a 36-in. x 28½-ft picking belt where two pickers pick out limestone and other large gangue rocks onto a 24-in. x 85-ft belt conveyor out to a waste rock pile. Waste rock is used as backfill. The material remaining on the picking belt is fed into a Pennsylvania Dixie 36x30-in. moving breaker plate hammer mill where it is all crushed to minus ½ in. The hammer mill throughs combine with the screen throughs into a pump sump and are pumped up to the washing plant by a 10x8-in. Allis-Chalmers CWG sand pump.

A unique water surge tank is contained in the space below the receiving hopper. The water table in this area is so close to the ground surface that excavation for equipment is kept to a minimum. Structures which would ordinarily be mounted at the surface, such as the receiving hopper, must be elevated to allow slope through the following equipment.



ALL BUILDINGS and equipment shown in illustration at left are identified in this plan. Numbers which appear on flowsheet on following pages, also identify equipment shown in sections through washing plant, flotation plant and mill.

Processes Brazilian Phosphate

Matrix is pumped to the top of the washing plant and allowed to flow by gravity through the various washing phases. The slurry is sampled and passed over a 4x10-ft stationary stainless steel screen with 1-mm slots onto a 5x14-ft Hewitt-Robins double deck "Vibrex" vibrating screen with ¼-in. top and 14-mesh bottom deck. The screen throughs from the stationary screen and each of the succeeding vibrating screens are combined into the cyclone feed pump sump at the ground floor of the washing building.

The plus 14-mesh product of the first vibrating screen is fed to the 6x6-ft Wemco "Mud-Hog" or rotary disintegrator where violent attrition takes place at about 65% solids. The attritioned product flows to a 5x8-ft single deck Hewitt-Robins "Vibrex" screen with a 14-mesh deck then to the first 30-in. x 30-ft Georgia Iron Works duplex log washer. The combined log washer products, overflow, flow to the second 5x8-ft "Vibrex" screen with a 14-mesh deck.

Screen overflows to the second 30-in. x 30-ft G.I.W. log washer, the log products again are combined and fed to a 5x14-ft double deck "Vibrex" screen with ¼-in. top and 14-mesh bottom deck. The plus ¼-in. screenings may be diverted either to an 8-in. x 52-ft centers centrifugal discharge bucket elevator back up to the No. 1 log washer or may be routed to an 18-in. x 79-ft belt conveyor which will convey the ¼-in. product to a stockpile where it can be reclaimed as concrete sand. When there is insufficient ¼-in. material in the circuit to maintain proper log washer action, pebble stone may be added with a front end loader into the bucket elevator feed chute.

A by-pass chute, which eliminates the second 5x8-ft vibrating screen and the second log washer from the washing plant flow, may be operated for free washing ores.

As previously mentioned, the composite screen troughs, the minus 14-mesh fraction, is combined into the cyclone feed pump sump and pumped vertically into two batteries of 12x10-in. Krebs cyclones, each set for a 325-mesh separation. Cyclone overflow may be recirculated or pumped to the waste pumps for disposal. The cyclone underflow going by gravity to the 30-ft dia Dorr Hydroseparator where a separation at 150 mesh is made.

The receiving and washing plants are designed to operate only 16 hr per day, while the flotation, and drying and grinding section will operate 24 hr per day. A 40-ft dia slurry storage tank is used as a surge tank for the 8-hr interim operation.

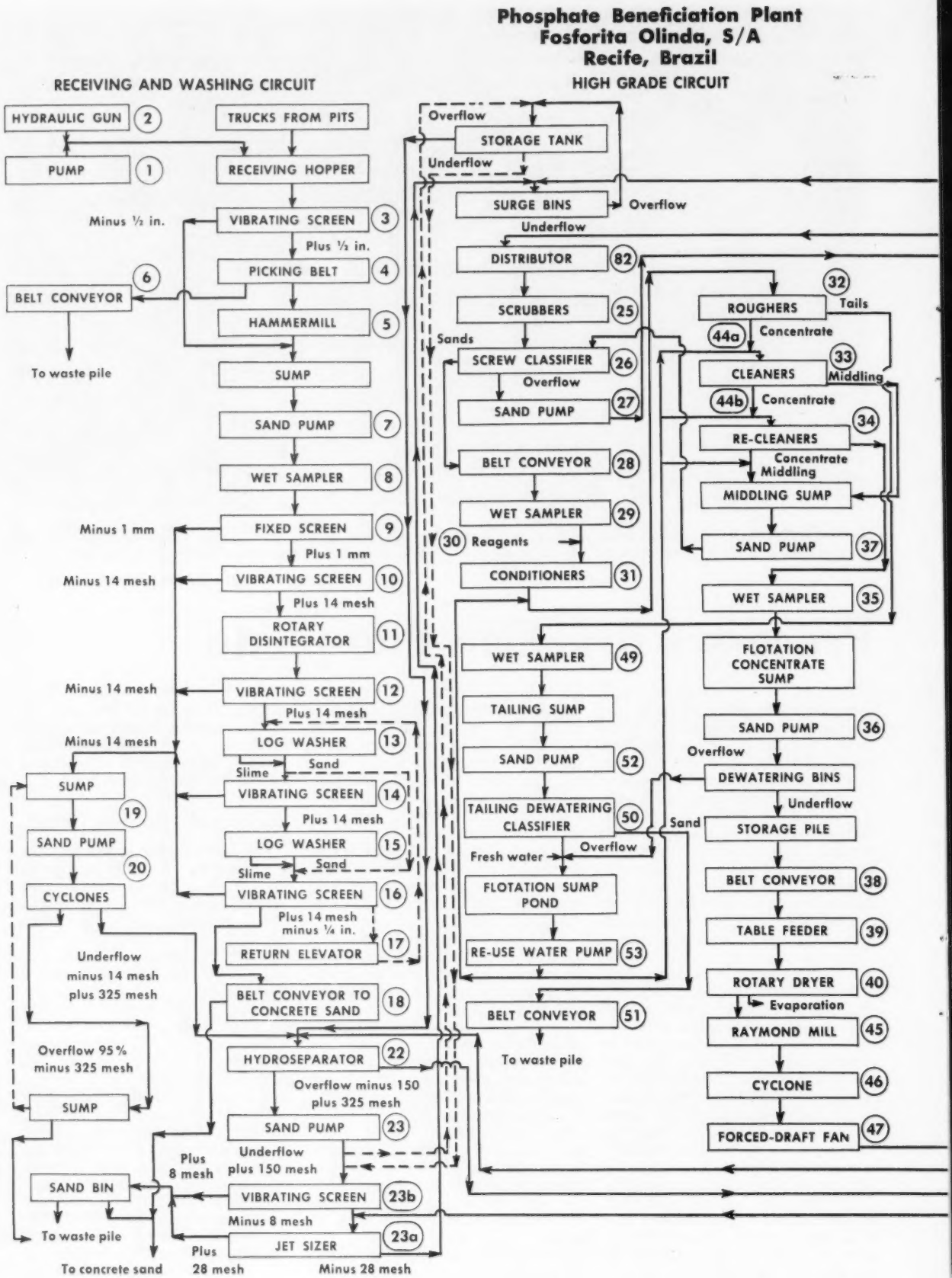
High-Grade Flotation Circuit

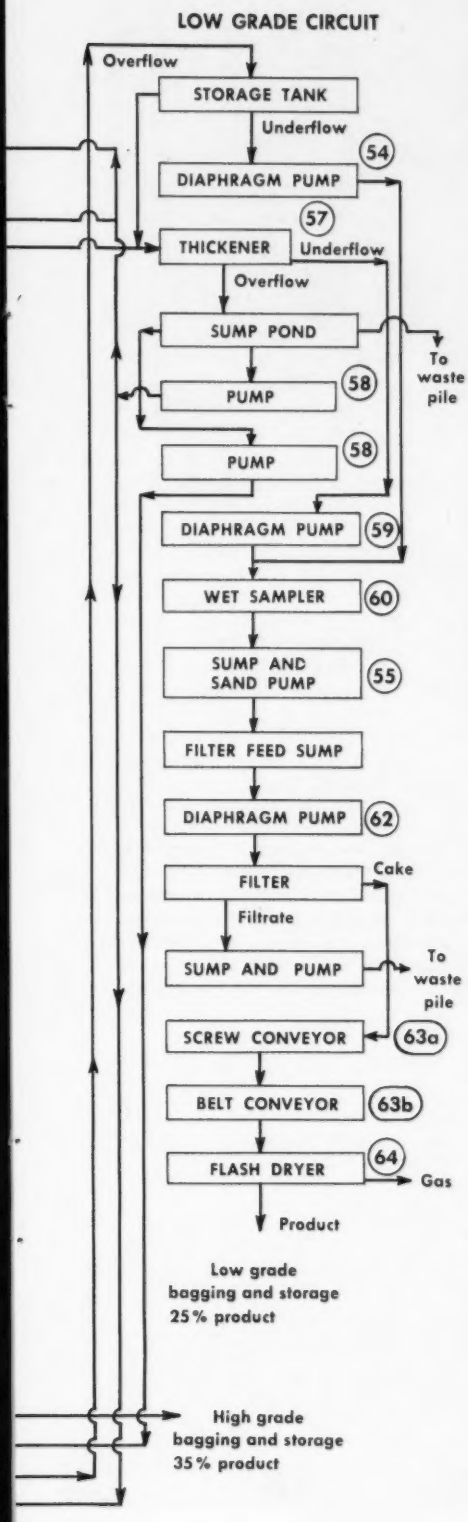
The 14x150-mesh hydro-underflow is pumped by an 8x6-in. Allis-Chalmers CWG sand pump up to a 5x8-ft "Vibrex" single deck tramp screen with a 0.096-in. deck. The screen throughs being the feed to a 6½-pocket Dorrco Jet-Sizer. The 14x28-mesh sands from the first several spigots of the sizer are combined with the tramp screens overs and are sold as concrete sand.

The 28x150-mesh sizer products are laundered into either of two 20-ft dia surge bins from which flotation feed is metered out with Farris pinch values into a motorized 2-way, 60-in. dia Denver pulp distributor. Twenty one and one half tons per hour is fed to each of two rows of six Wemco Fagergren 56x56-in. scrubber cells.

The combined scrubber products are laundered into a 60-in. x 35-ft 9-in. Wemco SH Series 150 classifer with full flared tank. The overflow is

(Continued on p 90)


Phosphate Beneficiation Plant
Fosforita Olinda, S/A
Recife, Brazil
RECEIVING AND WASHING CIRCUIT
HIGH GRADE CIRCUIT
HYDRAULIC GUN 2
PUMP 1
TRUCKS FROM PITS
RECEIVING HOPPER
Minus ½ in.
VIBRATING SCREEN 3
Plus ½ in.
PICKING BELT 4
6
BELT CONVEYOR
To waste pile
HAMMERMILL 5
SUMP
SAND PUMP 7
WET SAMPLER 8
Minus 1 mm
FIXED SCREEN 9
Plus 1 mm
Minus 14 mesh
VIBRATING SCREEN 10
Plus 14 mesh
ROTARY DISINTEGRATOR 11
Minus 14 mesh
VIBRATING SCREEN 12
Plus 14 mesh
Minus 14 mesh
LOG WASHER 13
Sand
Slime
SUMP
19
VIBRATING SCREEN 14
SAND PUMP
20
Plus 14 mesh
LOG WASHER 15
Sand
Slime
CYCLONES
VIBRATING SCREEN 16
Plus 14 mesh
minus ¼ in.
RETURN ELEVATOR 17
Underflow
minus 14 mesh
plus 325 mesh
BELT CONVEYOR TO CONCRETE SAND 18
Overflow 95%
minus 325 mesh
HYDROSEPARATOR 22
SUMP
Overflow minus 150
plus 325 mesh
SAND PUMP 23
Plus
8 mesh
Underflow
plus 150 mesh
SAND BIN
VIBRATING SCREEN 23b
Minus 8 mesh
To waste pile
JET SIZER 23a
Plus
28 mesh
To concrete sand
Minus 28 mesh
Overflow
STORAGE TANK
Underflow
SURGE BINS
Overflow
Underflow
DISTRIBUTOR 82
SCRUBBERS 25
Sands
SCREW CLASSIFIER 26
Overflow
SAND PUMP 27
BELT CONVEYOR 28
WET SAMPLER 29
30 Reagents
CONDITIONERS 31
WET SAMPLER 49
TAILING SUMP
SAND PUMP 52
TAILING DEWATERING CLASSIFIER 50
Fresh water
Overflow
FLOTATION SUMP POND
RE-USE WATER PUMP 53
BELT CONVEYOR 51
To waste pile
32
ROUGHERS
Tails
44a
Concentrate
33
CLEANERS
Middling
44b
Concentrate
34
RE-CLEANERS
Concentrate
Middling
MIDDLING SUMP
SAND PUMP 37
WET SAMPLER 35
FLOTATION CONCENTRATE SUMP
SAND PUMP 36
Overflow
DEWATERING BINS
Underflow
Sand
STORAGE PILE
BELT CONVEYOR 38
TABLE FEEDER 39
ROTARY DRYER 40
Evaporation
RAYMOND MILL 45
CYCLONE 46
FORCED-DRAFT FAN 47



LEGEND

1. Two 6x8-in. water pumps, 100 hp each
2. Two hydraulic guns, 1600 gpm at 70 psi
3. Vibrating screen, 5-ft x 12-ft 2½-in. top deck, ½-in. bottom deck, 10 hp
4. Picking belt conveyor, 36 in. x 28 ft 6⅜-in., 3 hp
5. Non-clog hammer mill, 36x30-in., Penn-Dixie, with 100-hp hammer and 3-hp breaker plate
6. Belt conveyor, 24 in. x 85 ft, 3 hp
7. Sand pump, 10x8 in., 125 hp
8. Automatic standard-duty wet sampler, ¼ hp
9. Stationary screen, 4x10 ft
10. Vibrating screen, 5-ft x 8-ft ¼-in. top, 14-mesh bottom, 10 hp
11. Wemco rotary disintegrator, 6x6 ft, 75 hp
12. Vibrating screen, single deck, 5x8 ft, 14 mesh, 5 hp
13. Duplex log washer, 30 in. x 30 ft, 50 hp
14. Vibrating screen, single deck, 5x8 ft, 14 mesh, 5 hp
15. Duplex log washer, 30 in. x 30 ft, 50 hp
16. Vibrating screen, 5-ft x 14-ft ¼-in. top, 14-mesh bottom, 10 hp
17. Bucket elevator, 8-in. buckets, 52 ft long, 2 hp
18. Belt conveyor, 18 in. x 79 ft, 3 hp
19. Three sand pumps, 8x6 in., cyclone feed, 60 hp each
20. Twelve Krebs cyclones, D-10-B
22. Hydroseparator, 30-ft dia, Dorr "AX", 5 hp
23. Sand pump, 8x6 in., Hydroseparator underflow, 75 hp

23a. DorrCo jet sizer

23b. Vibrating screen, 5x8 ft, single deck, .096-in. opening, 5 hp

25. Twelve Fagergren scrubber cells, 56x56 in., 20 hp each
26. Wemco screw classifier, 60 in. x 35 ft 9 in., Series 150, 7½ hp
27. Sand pump, 6x4 in., classifier overflow, 20 hp
28. Belt conveyor, 18 in. x 83 ft, 3 hp
29. Automatic wet standard-duty sampler, ¼ hp
30. Two Clarkson Duplex reagent feeders, No. E2, 1/20 hp each
31. Three Wemco conditioners, 4x4 ft, extra heavy duty, 10 hp each
32. Ten Fagergren rougher cells, 56x56 in., 15 hp each cell, ¼ hp each machine
33. Four Fagergren cleaner cells, 56x56 in., 15 hp each cell, ¼ hp each machine
34. Four Fagergren re-cleaner cells, 56x56 in., 15 hp each cell, ¼ hp each machine
35. Automatic wet standard-duty sampler, ¼ hp
36. Two sand pumps, 6x4 in., flotation concentrate, one stand-by, 40 hp
37. Two sand pumps, 6x4 in., flotation middling, one stand-by, 10 hp
38. Belt conveyor, 18 in. x 282 ft, 5 hp
39. Table feeder, 60-in. Hardinge, 2 hp
40. Rotary direct oil-fired Hardinge "XH"-10 dryer, 70 in. x 60 ft, 30 hp
41. Multiclone rotary air-lock dust collector, No. 36-6, ½ hp
42. Clarage No. 129 XL induced-draft fan, 40 hp
43. Bucket elevator, 10 in. x 47 ft 7 in. long, continuous discharge, 5 hp

44a. Screw conveyor, 12 in. x 48 ft long, 5 hp

44b. Screw conveyor, 12 in. x 82 ft long, 5 hp

45. Two No. 6669 Hi-side roller mills and Whizzer separator with 250-hp mill, 1½-hp feeder, and 15-hp Whizzer
46. Two cyclone collectors, 12-ft dia
47. Two forced-draft fans of 150 hp each
48. Two Denver-Vezin automatic dry samplers, 40 in., dust tight, 1 hp
49. Automatic wet standard-duty sampler, ¼ hp
50. Wemco screw classifier, Series 150, 36 in. x 23 ft 9 in., 3 hp
51. Belt conveyor, 18 in. x 79 ft, 3 hp
52. Two sand pumps, 6x4 in., one stand-by, flotation tail, 20 hp
53. Two re-use water pumps, 6x5 in., one stand-by, sump pond, 30 hp
54. Duplex diaphragm pump, 4 in., 50-ft underflow, 2 hp
55. Two sand pumps, 6x4 in., one stand-by, underflow to filter feed sump, 30 hp
56. Two 2-in. Oliver Type L filtrate pumps, one stand-by, 10 hp
57. DorrCo thickener, 150-ft dia, 3 hp

58a. Two water pumps, 12x12 in., sump pond overflow, one spare water pump motor, 60 hp

58b. Two water pumps, 8x8 in., sump pond overflow, one stand-by, 100 hp

59. Two Duplex diaphragm pumps, 4 in., 150-ft thickener underflow, 4 hp

60a. Two automatic wet standard-duty samplers (2 cutters), ½ hp

61. Three Dorr-Oliver disc filters, 8-ft 6-in. dia, with eight discs, 3 hp each
62. Three 4-in. Dorr-Oliver diaphragm pumps, filter feed, one stand-by

63a. Screw conveyor, 12 in. x 56 ft, 5 hp

63b. Belt conveyor, 18 in. x 43 ft 6 in., 3 hp

64. Cage mill, flash dryer, 30-in. double-paddle mixer, 50-hp mill, 40-hp mixer
65. Cyclone collector, 16-ft dia, 24-in. air-lock, 2 hp
66. Forced-draft fan, American Blower 900, type "E", 250 hp
67. Multiclone rotary air-lock collector, No. 80-8, ½ hp
68. Wet scrubber and circulating pump, 5 hp

69a. Screw conveyor, 12 in. x 24 ft, 5 hp

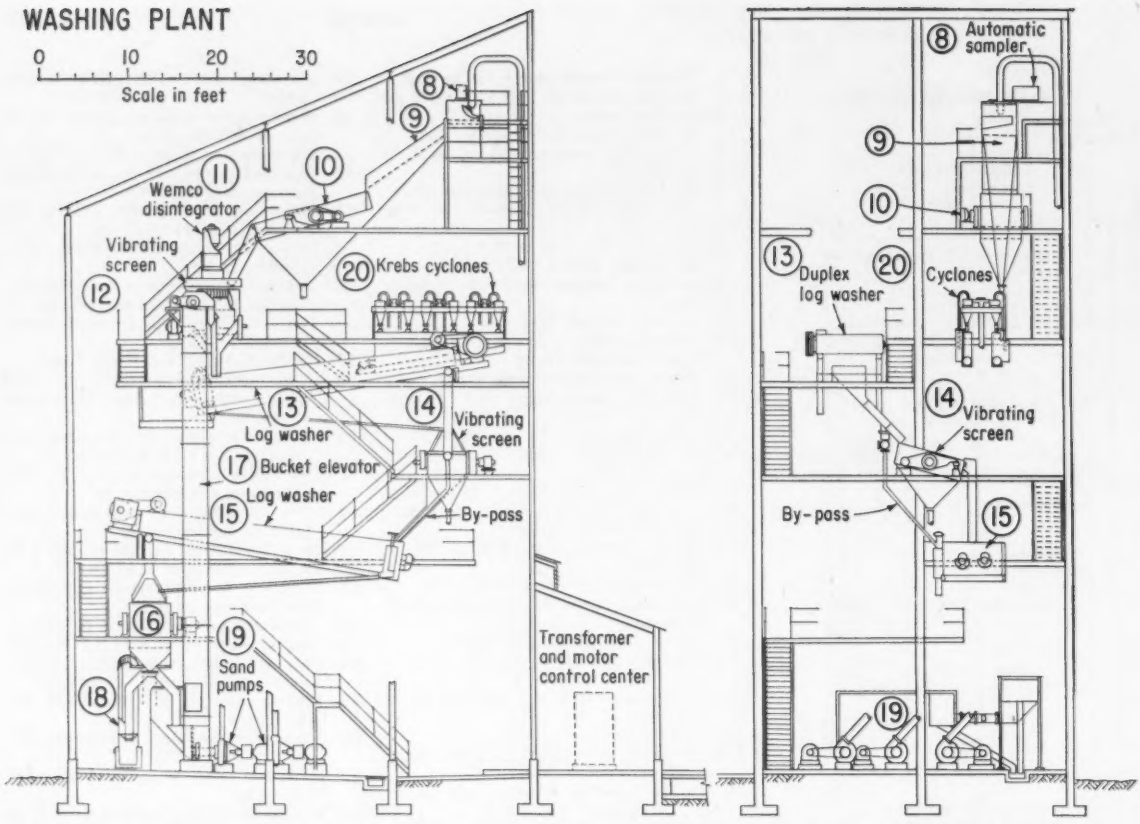
69b. Three 12-in. rotary cut-off valves

70. Denver-Vezin automatic dry sampler, 40-in. dust tight, ½ hp

71a. Screw conveyor, 12 in. x 18 ft, 3 hp

71b. Screw conveyor, 12 in. x 19 ft, 3 hp

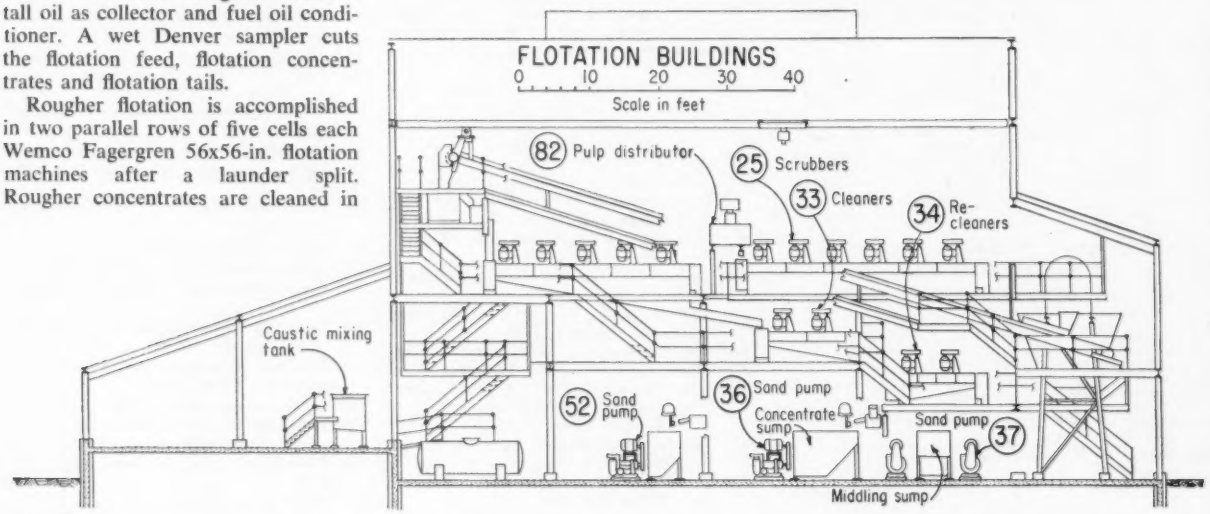
72. Richardson No. E50-Automatic bagging machine, 2½ hp
73. Sewing machine and bag conveyor, 1¼ hp
74. Two Richardson No. E50-Automatic bagging machines, 2½ hp
75. Two sewing machines and bag conveyors, 1¼ hp each
76. Three flat-belt conveyors, 24 in. x 43 ft 6 in., 5 hp each
77. Richardson automatic bagging scale, 500 lb, 3 hp
81. Platform scale
82. Pulp distributor, self rotating, 5 ft x 3 ft 10 in., 2-way split
83. Seven rotary vane packer feeders, 3 hp each
84. Dust collector and exhaust fan, 10 hp
85. Clarkson reagent feeder, Type E-2, 1/20 hp
86. Three Nash Hytor "L-7" vacuum pumps, 40 hp each
87. Vacuum receiver, 60x84 in.
88. Screw conveyor, 9 in. x 35 ft, 3 hp
89. Roots-Connersville "AF-59" blower, 1½ hp
90. Two oil pre-heaters, rotary dryer, 20 hp, flash dryer, 25 hp
91. Two fuel oil pumps, feed pump, 10 hp, circulating pump, 8 hp
92. Three reagent pumps, 3 hp
93. Two booster water pumps, 5x4-in. receiving plant, 30 hp each
94. Water pump, 10x8 in., slime pump, 125 hp
95. Water pump, 10x8 in., 75 hp



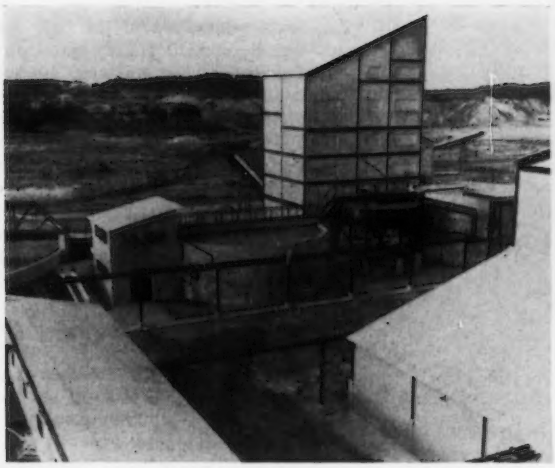
ALL NUMBERS on drawings in this article refer to equipment identified in the legend of the flowsheet on previous page. Feed to this washing plant is minus ½ in. It is pumped from a sump in the adjacent receiving plant.

pumped to the 150-ft thickener in the low-grade circuit. The classifier sands are dropped to an 18-in. x 83-ft belt conveyor which elevates it to the flotation conditioners. Conditioning is accomplished in three 4x4-ft Wemco high-solids, propellor type conditioners at 70% solids. Reagents used are tall oil as collector and fuel oil conditioner. A wet Denver sampler cuts the flotation feed, flotation concentrates and flotation tails.

Rougher flotation is accomplished in two parallel rows of five cells each Wemco Fagergren 56x56-in. flotation machines after a launder split. Rougher concentrates are cleaned in two 2-cell 56x56-in. Fagergren machines and recleaned in two additional two-cell Wemco Fagergren machines. Cleaner and recleaner tailings are pumped by a middling pump into the 60-in. dewatering screw classifier, and close circuited back to rougher feed. Recleaner concentrate is pumped to the high grade concentrate dewatering bins over the enclosed concentrate storage building. Rougher tailings are pumped to a 36-in. x 23-ft-9-in. Wemco SH Series No. 150, full flared tank, dewatering classifier where the



FLOTATION PLANT is designed to produce a high-grade product, running 35% P_2O_5, and a low-grade product running 25% P_2O_5. About two-fifths of the total phosphate is contained in the minus 200-mesh product.



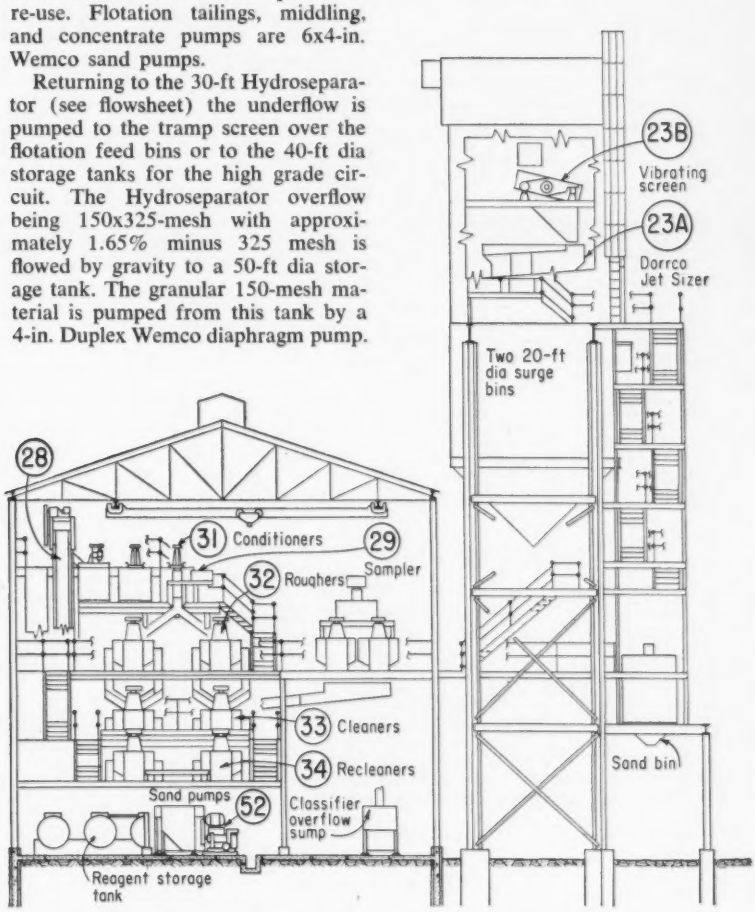
PHOSPHATE MATRIX is mined in open-pit shown in background. Washing plant and storage tanks appear in foreground.

BELT FEEDS high-solids conditioners. Circuit includes two 5-cell roughers, two 2-cell cleaners, and 2 scrubbers.

sands are dewatered and conveyed by an 18-in x 70-ft belt conveyor to a stockpile. The tailing classifier overflow is settled in a concrete reclaiming pond and the effluent water recirculated to the flotation plant for re-use. Flotation tailings, middling, and concentrate pumps are 6x4-in. Wemco sand pumps.

Returning to the 30-ft Hydroseparator (see flowsheet) the underflow is pumped to the tramp screen over the flotation feed bins or to the 40-ft dia storage tanks for the high grade circuit. The Hydroseparator overflow being 150x325-mesh with approximately 1.65% minus 325 mesh is flowed by gravity to a 50-ft dia storage tank. The granular 150-mesh material is pumped from this tank by a 4-in. Duplex Wemco diaphragm pump.

flows by gravity to the feed well of the 150-ft dia Dorr thickener, combining with the slime overflow from the 60-in. classifier from the scrubbed flotation feed. Thickener overflow is



THE FLOTATION PLANT operates 24 hr per day. Receiving and washing plants operate 16 hr per day. A 40-ft surge tank feeds the mill 8 hr per day.

CLASSIFIER deslimes scrubbed flotation feed. Diameter of unit is 60 in.

OVERFLOW of 60-in. classifier is pumped to phosphate fines thickener.

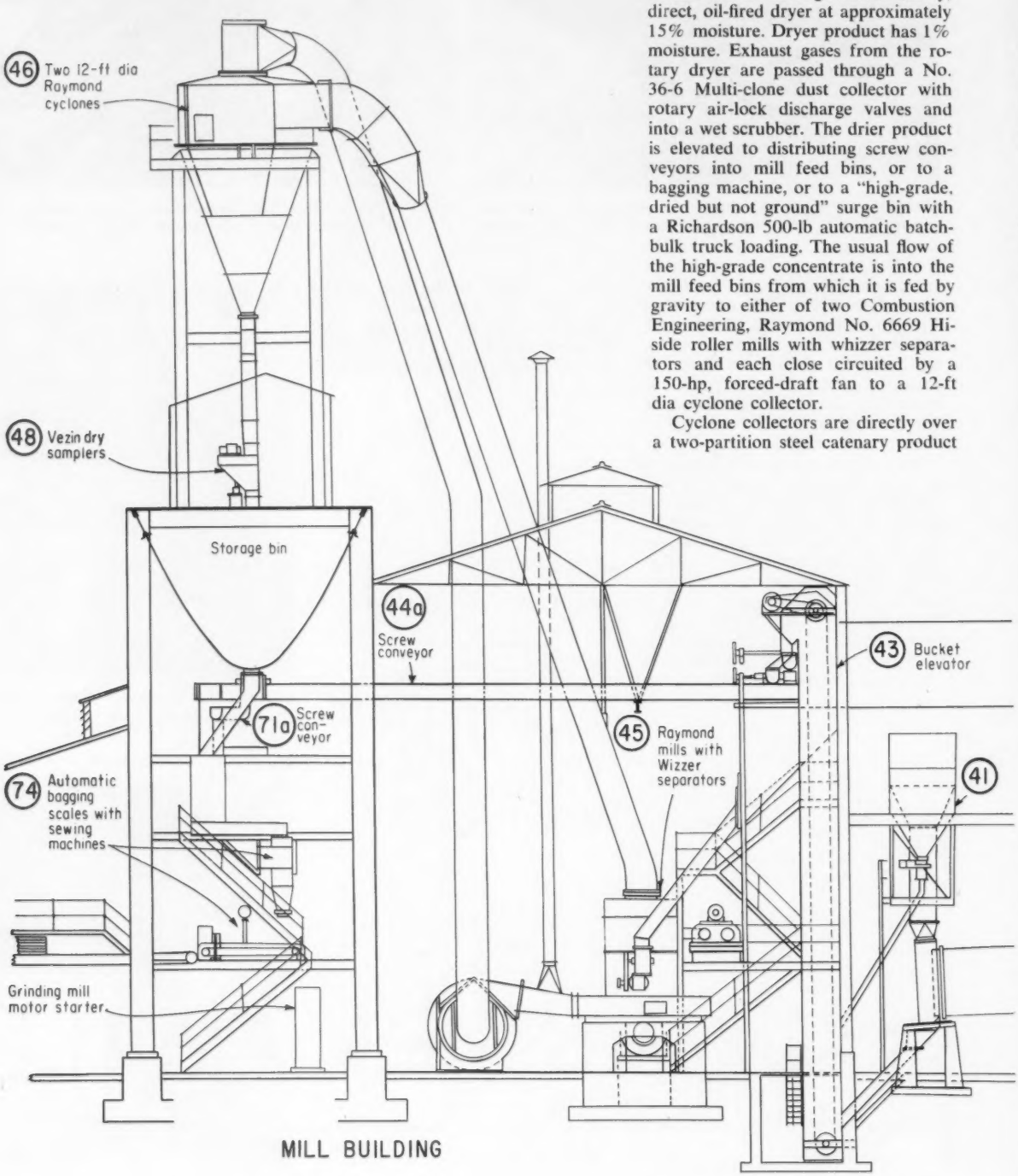
laundered to a sump pond for reclamation and re-use in the washing plant. Six Allis-Chalmers type "S" water pumps are used to recirculate overflow from the 50-ft storage tank water from the two sump ponds.

The 150-ft thickener underflow is pumped by two 4-in. Wemco duplex diaphragm pumps to the filter feed pump sump where it joins the underflow from the 50-ft storage tank. A Denver wet sampler with two cutters on a common arm cuts the two materials separately. Three 4-in. Dorr-Oliver diaphragm filter feed pumps located in the mill and dryer building are feed by a 6x4-in. Wemco sand pump at the thickener area.

Separate handling of the high and low grade products is maintained through the drying and grinding sections. The high grade flotation product is withdrawn from the storage building by an 18-in. x 280-ft belt conveyor to a dryer feed bin with a 5-ft dia Hardinge table feeder.

Flotation concentrates are fed to a 70-in. x 60-ft Hardinge XH-10 rotary, direct, oil-fired dryer at approximately 15% moisture. Dryer product has 1% moisture. Exhaust gases from the rotary dryer are passed through a No. 36-6 Multi-clone dust collector with rotary air-lock discharge valves and into a wet scrubber. The drier product is elevated to distributing screw conveyors into mill feed bins, or to a "high-grade, dried but not ground" surge bin with a Richardson 500-lb automatic batch-bulk truck loading. The usual flow of the high-grade concentrate is into the mill feed bins from which it is fed by gravity to either of two Combustion Engineering, Raymond No. 6669 Hi-side roller mills with whizzer separators and each close circuited by a 150-hp, forced-draft fan to a 12-ft dia cyclone collector.

Cyclone collectors are directly over a two-partition steel catenary product



FLOTATION CONCENTRATES are fed to the rotary dryer at approximately 15% moisture. Exhaust gases go to cyclones.

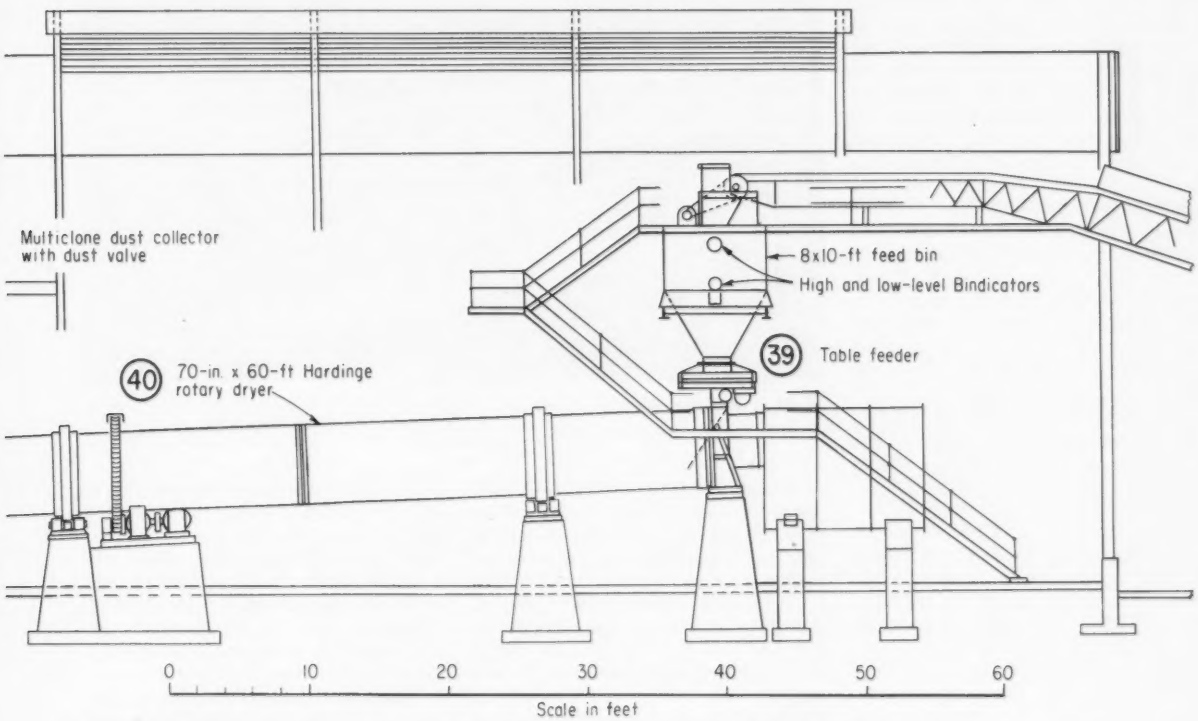
bin. Three Denver, totally enclosed, dust tight Vezin, dry type, automatic samplers cut each product flow into the storage bin. Finished product is fed to bagging equipment by six 12x 12-in. rotary vane feeders, two to each compartment, two compartments for high-grade and one compartment for low-grade concentrates. Concentrates flow by gravity and are distributed by screw conveyor to one, two or three Richardson No. E50 bagging machines with sewing machines and bag conveyors.

Low-grade concentrates as shown in the flowsheet are pumped to three Dorr-Oliver 8-ft 6-in. dia by 8-disc American Filters with three Nash HY-tor L-7 wet vacuum pumps and a No. AF 59 Roots-Connersville blower for air and vacuum. Filter cake drops to a screw conveyor which feeds a belt conveyor which discharges into a 30-in. Combustion Engineering double-paddle mixer which blends dried material with the filter cake in regulated proportions. Paddle mixer product drops into the Combustion Engineering Cage-Mill flash dryer. Heat is furnished to the flash dryer by an oil-fired furnace and an American Blower No. 900, Type E forced draft fan with a 250-hp motor which elevates the dried, hot low-grade concentrate to a 16-ft dia cyclone collector and a wet scrubber and stack. It may be pointed out that this is the first application of flash drying to phosphate ores commercially.

FLOTATION TAILINGS are dewatered in a 36-in., flared-tank classifier. Water is pumped to mill tank. Sands are stockpiled for use in concrete mixtures.

Engineering on Fosforita Olinda S/A was done by the Western-Knapp Engineering Co.'s New York office, which is managed by R. T. Lassiter. The late E. J. (Jake) Maust of Western Machinery Co., New York, was metallurgical consultant and all engineering and design was under technical supervision of Dr. J. Britto P. Passos of Fosforita Olinda.

Architecturally, the buildings at Fosforita Olinda are unique in that building walls are stuccoed concrete block with flush support beams as required. Due to its tropical setting, openings in building walls have tile grills which give them an arabesque appearance. Space has been allowed in the mill for an additional (future) grinding mill and an additional filter. Fosforita Olinda S/A is currently planning an expansion which will approximately double production. Expansion plans as well as other business is handled through their representation, John M. H. Shline Co., 342 Madison Avenue, New York 17, New York.



DRYER PRODUCT is elevated to mill feed bins or to screw conveyor feeding bagging machines.

INTEGRATED operation at Corpus Christi, Texas, features a four-ship ore fleet, unloading dock in foreground, a large alumina plant (center) and the reduction works in the background with the gas-burning power plant in the white buildings.

Operating Large Aluminum Pots at

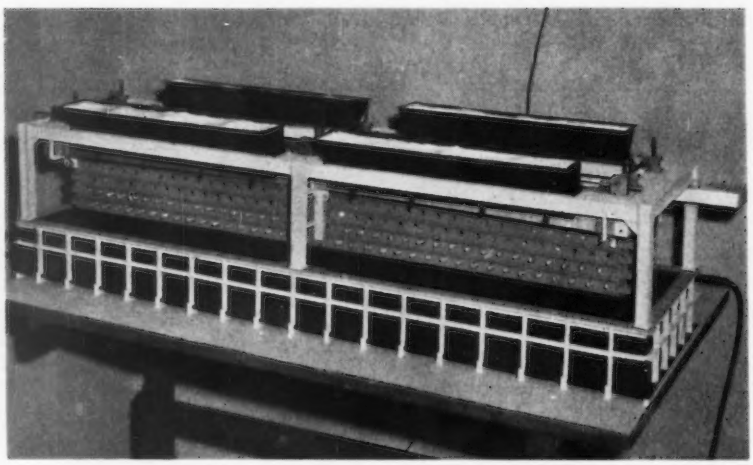
JAMES W. FRANKLIN

REYNOLDS METALS CO.'s San Patricio reduction works represented one of the world's largest potlines, with the largest pots ever used in the industry, when it was constructed in San Patricio County, some 14 miles from Corpus Christi, Texas in 1951-1952.

Rated plant capacity is 190-million lb of aluminum annually. All the buildings (see sketch on opposite page) are sheathed in Reynolds corrugated industrial 3S alloy sheet (0.032 in.). In addition, some 8,000 sq ft of corrugated Plexiglas were used to window the potlines of which there are two with two pot rooms each. Each pot room is in a separate building, 1580 ft long by 70 ft wide.

Nearby is the metal storage building which parallels the pot rooms on the north, and houses the holding furnaces and casting machines. A concrete railroad siding is located next to this building, and from here shipments are made to all parts of the Free World.

In addition to nearly 5 miles of standard-gage railroad track within the property Reynolds has a small 30-gage line running crosswise through the pot rooms to the carbon plant. Carbon is moved on this track by an electric tractor.

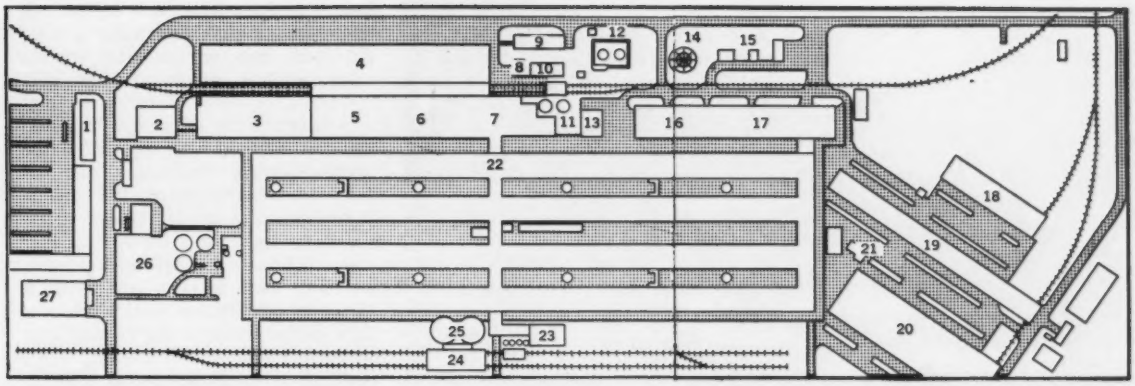


SCALE MODEL clearly shows the design of Reynolds' large single anode pots with charging hoppers for alumina on top, pins and anode channels on the side.

A steam plant with 13,500 lb/hour capacity is located next to the carbon building where coke, coal, pitch are blended as required for anodes or the cathodes.

Production capacity for 190 million lb of aluminum calls for a lot of material handling and storage capacity. In the electrolyte building, elevated concrete storage tanks were placed for fluorspar, aluminum fluoride, soda ash and cryolite. An elevator conveyor moves these granular materials from incoming railroad cars into the storage bins. Storage capacity is available for 3,000 tons of petroleum coke, 150 tons of calcined anthracite, 175 tons of metallurgical coke, 120 tons of soda ash, 160 tons of fluorspar and 330 tons of cryolite — enough for about 30 days operation.

Alumina represents the largest volume of material handled—about 475 tons a day at design capacity. Alumina

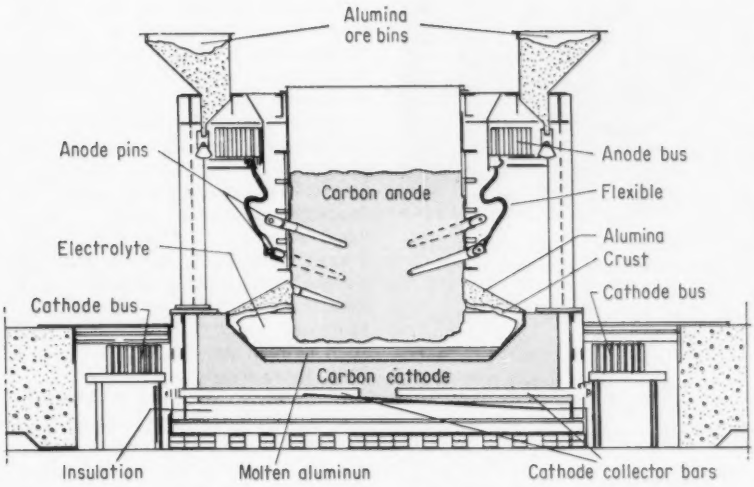


REDUCTION works layout is clean-cut, providing the shortest bus bar-to-power plant distance possible.

LEGEND

1. General office
2. Wash and locker building
3. Covered storage
4. Open storage and truck loading dock
5. Metal service
6. Holding furnaces
7. Carbon plant
8. Dispensary
9. Laboratory
10. Training building
11. Coke storage tanks
12. Pitch storage tanks
13. Air compressors and boilers
14. Elevated water tank
15. Service buildings
16. Warehouse
17. Maintenance shop
18. Power house (ac)
19. Power house (dc General Motors)
20. Power house (dc Cooper-Bessemer)
21. Control room and power house office
22. Pot rooms
23. Electrolyte storage and unloading
24. Alumina unloading
25. Alumina storage
26. Recovery plant
27. Water reservoir and pump house

Reynolds' Corpus Christi



AS THE HARDENED paste anode is consumed, pin-pushing and pin-pulling crews change flexible connections, remove used pins and insert new ones in new channel.

is delivered from the nearby Sherwin works by railroad covered hopper-bottom cars and mechanically transferred at up to 2500 lb/min to two large concrete storage bins having a combined capacity of 11,000 tons. The tanks are 65 ft dia by 70 ft high with domed concrete roofs. Alumina goes from here to a day storage tank from where it is destributed to the pots.

Alumina is discharged from the day tank as needed into large 30-ton portable hoppers which are moved by the 30-ton overhead cranes (two 15-ton hoists, by Harnischfeger) to be dumped into the alumina bins on each pot.

The four pot rooms, each 1580 ft long are arranged alongside each other with the power houses at one end to present the shortest bus route possible. Each pot is of the Soderberg continuous, self-baking anode type operated in series with a 4.5 to 5.5 volt drop between pots. Voltage enters the room at about 675 v and from 130,000 to 140,000 amp.

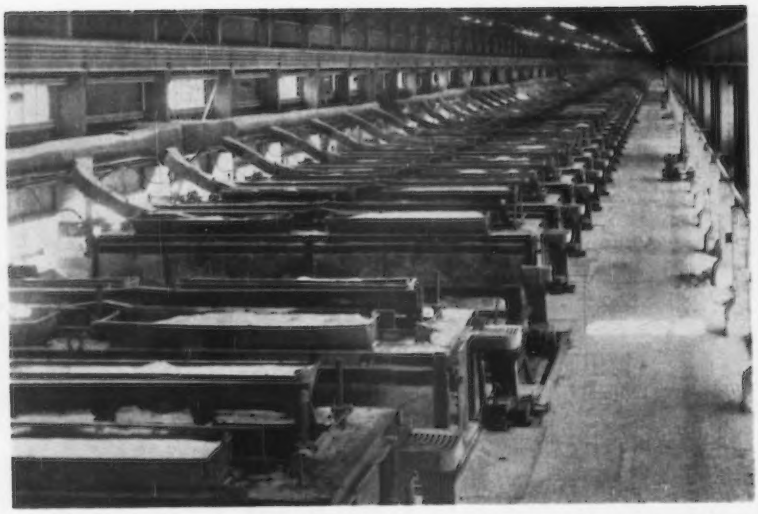
Aluminum was chosen for the bus material, because even though aluminum has a conductivity of 62% of copper per sq inch, a pound of aluminum will carry twice as much current as a pound of copper. As both metals are sold on a per-pound basis, the total dollars for aluminum were considerably below that for copper. Also because the aluminum is lighter and more easily worked, additional savings were made in the fabrication and erection of the bus.

It takes a lot of aluminum to make aluminum — Reynolds used 10,000 tons of it to make the bus bars for San Patricio.

Bus bars connect to the first pot's anode, and the rest of the pots in the room are connected cathode of one to anode of the next down the line. At the end of the first pot room in either line the bus passes into and through the next room in the same manner, and finally enters the power house to complete the circuit.

Using two rooms to a potline and two potline to the plant permits a wide range of operating capacity in addition to the advantage of the shortest possible bus connections. With only 4.5 to 5.5 volt drop across a pot, and with all the pots insulated, there is a minimum of electrical hazard to the workers. But leave your watch and compass outside the pot room!

All bus bars surfaces to be joined



RATED plant capacity is 190-million lb of aluminum annually from two potlines consisting of two pot rooms each with a total of 280 pots in service or repair.

POT OPERATION is still an art—the operator controls the alumina and reagent addition, crust breaks, tapping time, depending on what he sees and hears.

by bolted connections are sanded with a portable electric belt sander, then polished with a disk sander. A smooth, tight, clean surface is a must for good contact and to prevent current losses. To prevent surface oxidation, No-Oxid paste is applied. A special crew moves about the plant to clean, check and tighten all bolted connections on a regular work schedule.

All other electrical connections are welded to improve conductivity and to eliminate the bolts which tend to oxidize and overheat at these high currents.

Aircomatic welding machines, using helium-argon shield are used to make electrical welds with 2S bare aluminum 1/16-in. wire being fed to the arc at 100 in./min or 60v and 280 amp. On long runs of the bus, aluminum expansion joints made of 10x40-in. aluminum sheets clamped tightly together and welded at desired places in the line were used.

Why Large Pots

The large anodes at San Patricio (four times the surface area of the first Listerhill pots) assure a smaller exposed surface area, thus lowering the heat losses. Normally aluminum pots operate in the 75 to 90% current efficiency range. Reynolds pots operate on the high side of this range.

Once a pot goes on the line it will stay in operation, barring a reduction in plant capacity, for months or years. But eventually, the aluminum finds a way through a weak spot or crack in the cathode. It is then necessary to remove the pot from service for rebuilding.

The superstructure, which carries the anode and its auxiliaries, is removed and the two parts of the cell allowed to cool. The anode is later put back into service after routine repair work is performed where necessary.

Another crew digs out the old cathode compartment and ships the cryolite-bearing material (periodically) to Listerhill where the cryolite is reclaimed. A plant-designed Ingersoll-Rand type chisel bit X-72 sinker and a plant-designed Wain-Roy backhoe are used in the compartment cleanout. The empty shell is cleaned then moved down to the maintenance shop for further restoration. Here parts are replaced, welded or straightened as needed. In the meantime another repaired shell is put back into the cathode pit from which the worn-out pot has been removed.

The shell is set into the foundation on I-beams set on insulation material. When the pot is back in operation, ventilation and cooling air is blown through this air space to cool the pot bottom. Pre-baked carbon blocks with cathode collector bars already in place are set in the shell. Blocks are hard and dense, measuring about 93x16 in. square, and improve pot operation as well as reduce the possibilities of leaks and cracks forming.

The space between the blocks and the ends of the shell are rammed with carbon-pitch mixture (anthracite coal, foundry coke and pitch) to form the desired cathode cavity which measures about 120 in. wide by 20 in. deep by 40 ft long.

Next, the cavity is filled with foundry coke resistor prior to the placing of the anode. The superstructure is replaced and the anode bus connected. Current, ranging from 6,000 amp to ½ full load, is passed through the coke, igniting it, and baking the cathode compartment into a hard firm mass. Temperature reaches 1500 deg F, and about half of the pitch used in the ramming is burned out. The rest carbonizes.

When the cathode has been baked, the residual coke is raked out and discarded. Liquid electrolyte is added and the pot is placed in operation. Alumina is added and the pot goes onstream, back in series with the rest of the potline. Alumina and electrolyte are added or adjusted as described below, based on analysis voltage controls and operator knowhow. The pot operates at about 960 deg C.

What's in the Electrolyte

High-purity anhydrous alumina from the Sherwin plant next door is dissolved in the cryolite, a double fluoride salt of aluminum and sodium. Cryolite is mined at only one place

in the Free World, Greenland, and is refined in the U.S. only by PennSalt Chemical Corp., Natrona, Pa. by crushing, grinding and a unique pine tar-Rada amine flotation process.

Synthetic cryolite, which really is not cryolite at all but a mixture of NaF and AlF with the same chemical composition as natural cryolite, can and is used in aluminum cells instead of natural cryolite. Reynolds generally uses about ½ liquid bath and ½ synthetic cryolite to start cells.

All the aluminum companies have synthetic cryolite manufacturing or recovery plants. Reynolds has one at Listerhill, Ala. which recovers cryolite from all used carbon cathode material in several of the Reynolds plants. There is also a recovery plant at San Patricio which is used to recover cryolite from the effluent of the pot room collection system. Synthetic cryolite is made from a mixture of hydrofluoric acid, aluminum hydrate and soda ash by a number of processes.

Fluorides Reduce Temperature

Cryolite melts at 1000 deg C, and will melt at about 940 deg C when it contains 15% of dissolved alumina. But should the percentage of alumina increase above 15%, the melting point rises rapidly—a control point in the operation of the pots (see below).

Fluorspar, at up to 10% concentration, is added to the cryolite to further reduce the melting point. Small amounts of aluminum fluoride are also added to tie up any free Na_2O that forms during the reaction — $2Al_2O_3 + 3C \rightarrow$ cryolite at 940 deg C $\rightarrow 4Al^\circ \downarrow + 3CO_2 \uparrow$ —and to replace any fluorine lost in the dissociation. Sodium fluoride or soda ash may also be used to control the pH and melting point.

All dust and the CO_2 produced by the consumption of the anode carbon is collected in dust collectors and water scrubbers. Effluent from the scrubbers is treated in the cryolite recovery pilot plant.

During the life of the pot, alumina is fed manually onto the crust, which forms on top of the cell, from alumina feeders attached to the superstructure. The crust is broken by a crust-breaking machine, two quarters of the crust on each shift, allowing the alumina to fall into the molten electrolyte where it is dissolved. The crust, in addition to being the source of the alumina for the bath and preheating the alumina, also serves as an excellent heat insulator — containing the heat is a major consideration in potline operation. Alumina is fed at about a 4,000 lb per day rate, producing about 2,000 lb a day aluminum. Analysis of the electrolyte determine when reagents are added and in what amounts.

Pushing and Pulling Pins

The anode is consumed at a constant rate as it lowers into the bath. The heavy carbon mass is held in place by rows of 10-in. steel channels bolted together to form a box (see drawing). As the anode descends, the channels must be removed before they touch the bath, melt and contaminate the electrolyte. To do this, the anode flexible connectors must be changed to the pins in the channel next above, and the used pins pulled by a special pin pulling rig developed by Reynolds. Then the lowest channel is removed. A channel width (10 in.) of carbon lasts about 13 or 14 days.

Pins pulled from the anodes are collected and straightened in presses located outdoors between the potlines. Defective pins are sent to the machine shop where they are forged back into shape and where the bolt holes are rehabilitated. The fresh, clean pins are stockpiled for reuse as needed.

As carbon is consumed, fresh carbon paste which is a mixture of petroleum coke and coal tar pitch is added to the anode holder by the crane. The paste spreads out evenly in the holder and is baked hard by the process heat. A new channel is added to the top and new pins are inserted into the soft anode before it has a chance to harden. A crew with a pin pushing rig does this job on regular work schedule. There are always three rows of pins (and three 10-in. channels) in place on the anode.

Contact between flexible and bus bar, flexible and pin, pin and anode are critical. All must be clean and tight, otherwise the pot will lose current efficiency.

Gap between anode and molten aluminum cathode is critical, and is maintained at approximately two inches. A normal pot carries about 10 inches of metal and 10 in. of electrolyte. When the pot is tapped each day, a heel of 8 to 10 in. of aluminum is maintained in the cathode compartment. It has been found that the pot works better when considerable aluminum covers the cathode (apparently the cell produces less sodium metal when the heel is present).

A siphoning crucible, under vacuum and preheated to avoid any possibility of an explosion on contact with hot aluminum, arrives at each pot on a regular schedule and withdraws a weighed amount of metal—usually one ton a day. There is one crucible for each of the three holding furnaces in the metal service building—each holding furnace taking a different grade of metal. Each pot is analyzed before the tapping to determine what crucible the metal goes into. Each full crucible is analyzed again to check the grade before being discharged into a holding furnace.

Crucible metal is skimmed, fluxed or alloyed as needed then dumped into a holding furnace from where the aluminum, again analyzed, is cast into pig or ingot. Reynolds has casting wheels and ingot molds for 30, 50 and 100 lb pig and 5-to-7,000 lb ingot. Shipments are made to Reynolds customers from the metal service loading dock by train and barge.

Pot Operation Is an Art

While the chemistry of the pot and its physical needs are well known, it takes highly skilled operators to tend the pots—it's still an art. The pot tender adds or subtracts reagents based on what he sees and hears around the pot. A "mucky" is one that contains too much alumina (melting point will rise) and the operator will hold off adding more alumina for a shift or two. Other pots may need more alumina and may get as many as two crust breaks a shift. Visual inspection of the flame color between the electrodes is another indication of pot conditions—a yellow-blue flame is normal; high yellow means too much sodium.

A safety light indicates when a pot is drawing too much voltage. Normally the pot should draw 4.5 to 5.5v and 130,000 to 140,000 amp. The 2-in. anode-to-cathode gap is critical in the operation of the pot. Too wide a gap causes a rise in voltage and the production of excess heat; too close a gap will short circuit the pot. The daily analysis of the electrolyte is also used by the tender to control the pot.

Reynolds Metals Co. operates a research farm next to the property where grain sorghum, cotton, clover, sesame and many truck products are raised. The purpose of the farm is to check the control of atmospheric pollution and the farm also cooperates with Texas Agricultural departments and local farmers to improve production, farm techniques and choice of crops. Grain produced on the farm is used at Reynolds Jamaica cattle ranch.

E&MJ would like to thank Dwight P. Keller, plant manager; F. D. Bressler, reduction plant superintendent; J. S. Apostolina assistant reduction plant superintendent; and Ben Wahrman, public relations, for their assistance in preparing and checking the accuracy of this manuscript based on a recent visit to Reynolds San Patricio.

NOW THAT THE LATEST expansion program at Reynolds Metals Co.'s Sherwin plant has been completed, the plant has a capacity of 1.8-million tons of bauxite. Sherwin and San Patricio combined cost $174-million to date. The two plants employ about 1600 persons with an annual payroll of approximately $10-million. The alumina plant was formerly called La Quinta, but was recently renamed Sherwin in honor of Ralph S. Sherwin, Sr., father of the present plant manager and a pioneer in the aluminum industry. Mr. Sherwin, Sr. developed the modified Bayer process used at Sherwin and described in the flowsheet shown on the following page. Large tanks in the foreground are the Pachuca-type precipitators.

Reynolds Expands Alumina Production

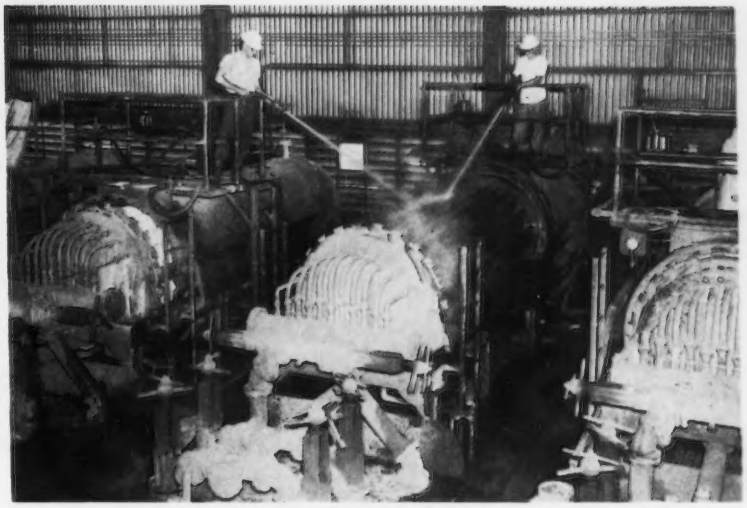
ORE USED at Sherwin is mainly Jamaican bauxite which arrives at the nearby pier on any one of the four Reynolds Caribbean Steamship Co. vessels (see flowsheet). Jamaican bauxite has rather low silica (but high ferric iron content) making it readily amenable to a modified Bayer process. Low silica is important in that it will not require as much caustic as higher silica ores, since in the reaction, silica present combines chemically with caustic and alumina to form a complex sodium aluminum silicate. Bauxite is reclaimed from the storage area on a 30-in. belt at about 70 tph and delivered to the grinding mill bins. A Merrick Weightometer is used to control feed rate to the bins. Five Hardinge 6x10-ft mills are used to grind.

E&MJ WOULD like to thank R. S. Sherwin, Jr., plant manager (shown above), E. B. Teas, assistant plant manager; W. R. Nelson, power plant superintendent; and Morton Handelman, senior process engineer, for their kind assistance in preparing and checking this manuscript, based on a trip to Corpus Christi during the expansion in 1958.

BAUXITE DELIVERED from storage is slurried with hot spent liquor fortified with caustic and is ground in the grinding mills. The mills discharge at 45% solids into the digesters where, with the aid of high temperature, the following reaction takes place:

bauxite $(Al_2O_3 \cdot 3H_2O) + 2NaOH \longrightarrow 2NaAlO_2 + 4H_2O$ + red mud

Here a pair of filtration hosemen aim a stream of water at a Kelly-type filter as they wash it down, preparatory to putting it back into use. Filters separate the red mud from the pregnant liquor and the sparkling clear alumina-bearing solution goes to the Pachuca-type precipitators below.



COUNTERCURRENT washing and decantation produces a purified pregnant solution which is pumped to the 218 Pachuca-type precipitators where seed alumina trihydrate is added, the solution circulated and agitated for 65 hours during which time the alumina trihydrate is formed and precipitated.

The trihydrate is filtered and washed, then dehydrated in kilns to anhydrous alumina:

$Al_2O_3 \cdot 3H_2O$ + heat $\longrightarrow Al_2O_3 + 3H_2O$

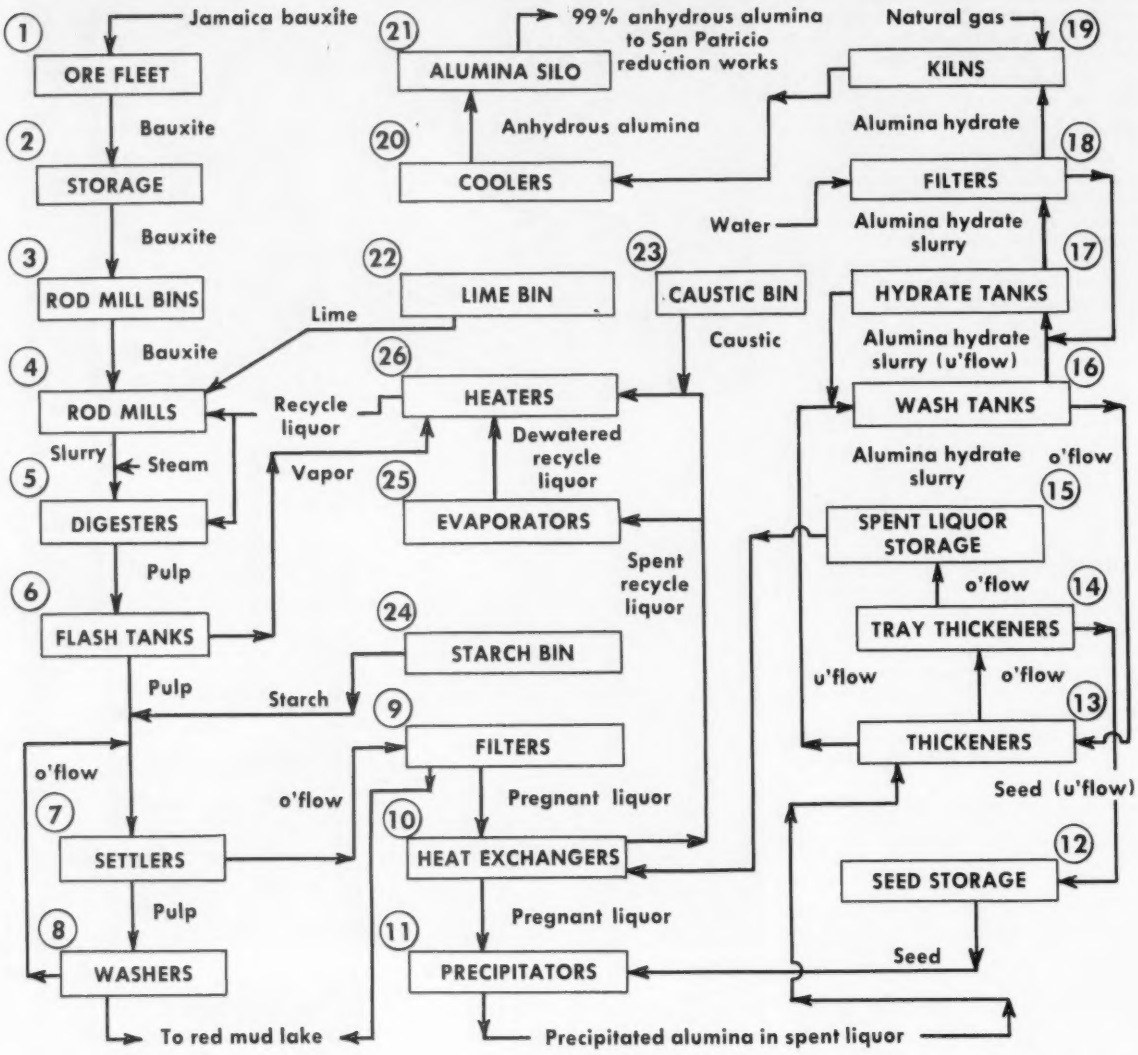
FINAL PRODUCT is anhydrous alumina, 99.1% Al_2O_3, which is loaded into railroad cars for delivery to San Patricio reduction works; or the alumina is loaded into barges or railroad cars for delivery to other Reynolds aluminum smelters, and even to other aluminum producers in the U.S.

Large F. L. Smidth Unax-type gas-fired kilns perform the dehydration at 2,100 deg F. From the kilns, the anhydrous alumina passes through Fuller Airslide conveyor-coolers, over a vibrating screen and into the alumina silo in the background.

(*Continued on next page*)

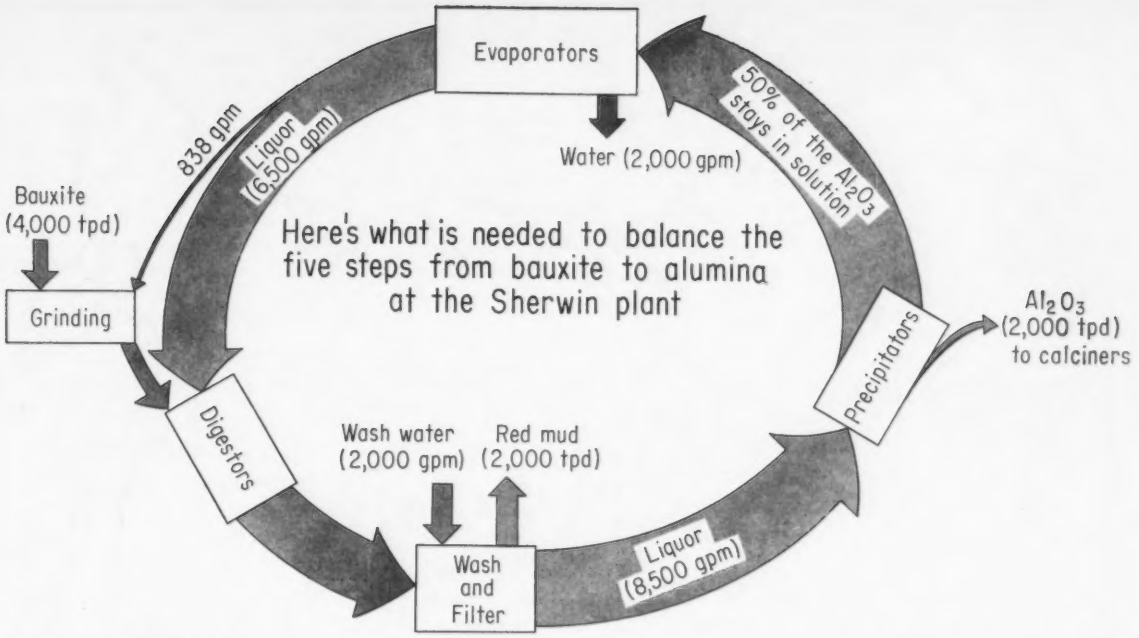
REYNOLDS METALS CO. SHERWIN ALUMINA WORKS

Corpus Christi, Texas



LEGEND

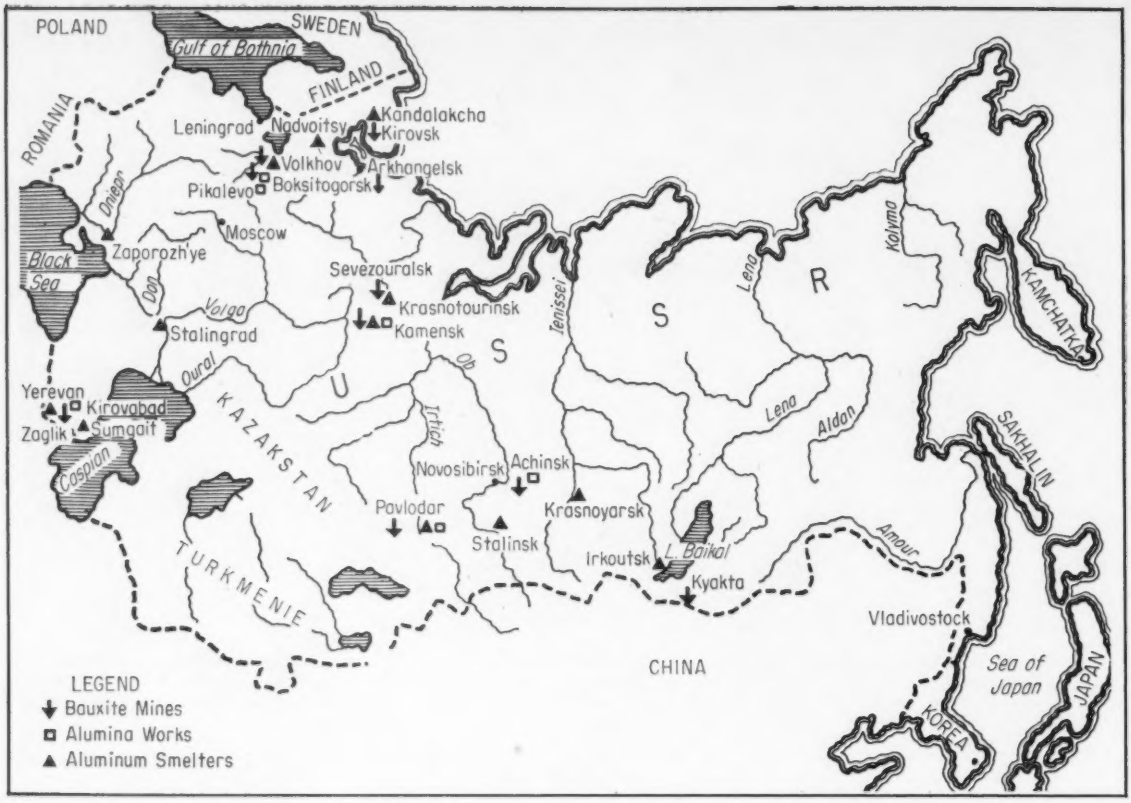
1. Jamaican bauxite (minus 2 in.) is delivered to Corpus Christi in four ore carriers owned by Reynolds subsidiary, Caribbean Steamship Co.—SS Louise, SS Dragon, SS Richard and SS Carl Schmedeman. Ships have from 7,500 to 30,000 ton capacity. Bauxite assays 40 to 49% Al_2O_3, 20 to 24% Fe_2O_3, 2 to 3% SiO_2, 2 to 3% TiO_2 and 13 to 15% moisture. Ore is unloaded by a Hewitt-Robins 48-in. pier belt and delivered over a Merrick Weightometer to another 48-in. Hewitt-Robins overhead bridge belt conveyor for storage in the bauxite building. Ships are unloaded at up to 3,000 tph rate.
2. Bauxite is reclaimed on a 30-in. belt at aproximately 70 tph and delivered to the grinding mill bins. Merrick Weightometer used ahead of the bins
3. Grinding mill bins, 350 ton capacity
4. Grinding mills (five) are Hardinge 6x10-ft rod mills using 2-, 3- and 4-in. balls or 3-in. rods depending on the type of ore being ground. Spent liquor is used to slurry the mill feed. Mills discharge at minus 20 mesh and 45% solids. Lime is added at the rate of 50 to 150 tpd, depending on spent solution and bauxite analysis
5. Slurry is digested in any of four digester series (each with three 10-ft dia by 30 ft units). A series operates with retention time or 30 minutes at 400 deg F, 200 psi (300 lb steam used). Digesters are top feed, bottom discharge, no mechanical agitation.
6. Digested slurry containing the dissolved alumina enters a train of flash tanks where steam pressure is reduced (along with temperature) in four steps. Flash goes to the preheaters (No. 26). Slurry and dissolved alumina goes to settlers at 225 to 230 deg F
7. Feed pulp enters the settlers—seven parallel four-deck, balanced-type tray thickeners, (40-ft dia) and four 90-ft dia single deck thickeners. Feed is split to these eleven as needed to maintain flow rates. Overflow goes to the Kelly-type filters and contains most of the dissolved alumina an some suspended red mud. Underflow is thickened red mud and passes to the washers
8. Red mud underflow, containing some valuable soda and alumina, enters any of eleven 5-deck, 55-ft dia continuous countercurrent washing tray thickeners. Overflow goes to the settler feed, returning residual alumina and soda to the



JAMAICAN BAUXITE (predominantly gibbsite and boehmite) is readily soluble in the process. Grinding only to minus 20 mesh is sufficient for economic extraction. Leach time is not too important —Sherwin maintains only 30 minutes contact time at 200 psi and 400 deg F. Caustic concentration and temperature are closely controlled at Corpus Christi.

process. Underflow is mostly thickened red mud which passes to two 175-ft dia final continuous countercurrent single-deck washer-settlers. Overflow from the final settlers goes back to first washers. Underflow is red mud and goes to the red mud lake which consists of multiple drying beds covering several hundred acres. Supernate from the lake returns to the process

9. Overflow from the settlers (No. 7) containing the alumina is filtered and washed in 38 Kelly-type filters which have stationary leaves and movable shells. 28 have 1,000 sq ft of cloth area. 10 have 2,000 sq ft. Clarified pregnant liquor goes through the heat exchangers and into the precipitators. Red mud cake is slurried and sent to the lake
10. Heat exchangers cool pregnant liquor to about 150 to 160 deg F, transferring the heat to spent process liquor going back to evaporators (No. 25)
11. Pregnant liquor enters any of the 218 precipitator tanks (200,000 gal capacity). Each is 24-ft dia by 60-ft straight, plus cone bottom, Pachuca type. Precipitator is filled with pregnant liquor containing 80 grams per liter alumina, seeded with fine alumina from seed storage, then circulated with air agitation. Air supply is important—to agitate, and to keep alumina from building up on the Pachuca walls. Three 6,000 cfm compressors—two Ingersoll-Rand steam and one I-R electric—supply the air. Another compressor (1200 cfm gas) was added in the expansion program. Further cooling takes place here
12. Seed storage tanks
13. Secondary thickeners (six) are 42-ft dia by 27-ft straights with cone bottom. Overflow is sent to tray thickeners. Underflow is crystalline alumina trihydrate and goes to wash thickeners. Wash is countercurrent
14. Tray thickeners recover some additional seed for seed tank, sends overflow to spent liquor. Thickeners are nine in number, each 40-ft dia tray type
15. Spent liquor storage
16. Wash tank gives hydrate another countercurrent wash, sends alumina to hydrate tank
17. Hydrate tank
18. Fourteen Dorrco internal filters, 12 ft by 7-ft dia, collect and wash alumina with effluent going to spent liquor tank
19. Alumina is dehydrated in seven countercurrent Unax-type F. L. Smidth kilns, gas-fired to 2,100 deg F. Kilns are 11-ft dia by 220 ft
20. Fuller Co. Airslide conveyor-coolers reduce temperature of kiln discharge
21. Alumina silo, 6,000 ton capacity. Railroad cars go under silos to load. Cars deliver to San Patricio or to market. Stack dust is collected in both cyclones and electrostatic precipitators. Bag collectors are used on conveyor system.
22. Lime bin. Lime is fed to grinding mills at 50 to 150 tpd. Purpose of lime is to control phosphorus and sodium carbonate in plant liquor
23. Caustic bin. Consumption is about 100 tpd into spent liquor going through heaters to the digesters
24. Starch bin. Feed rate is 20 tpd to the settler feed as a mud settling aid
25. Evaporators (combined forced and natural circulation type) distill out about 2,000 gpm water from the spent solution (about what was added in the red mud washing step). There are seven long-tube, vertical evaporators. Three are 6-effect and four are 5-effect. Six-effect units are Goslin-Birmingham. Two of the 5-effect are G-B and the other two are Chicago Bridge & Iron design. The units split the spent liquor feed, entering any desired point in the effect pattern. Some of the spent liquor by-passes the evaporators
26. Heaters preheat concentrated spent liquor after caustic addition and before liquor enters digester stage. Some liquor goes to the grinding mills, for slurrying bauxite. Natural gas is used to fire the kilns and to drive power producers in the powerhouse. Sherwin works consumes some 1.2-billion cubic ft of gas a month on an expanded four unit plant basis to produce 1.2-billion lb per hour steam, 24,000 cfm air and 24,000 kw electricity. Power plant contains four high pressure Foster Wheeler 850-psi boilers and two 350-psi package boilers by Babcock & Wilcox. Power is produced in four turbo-generators (two Elliotts and two General Electrics). Plant steam is delivered at 850 psi, 300, 100 and 50 as needed. Water is purchased from city of Corpus Christi through 26-mile line from treatment plant in 24-in. pipe laid by Reynolds. Water is used by both plants for process and drinking only. Boiler water is condensate with a small demineralizer on stand-by. Sherwin consumes about 4-million gpd water for all purposes



Courtesy of Revue de l'Aluminium

SOVIET alumina and aluminum mines, mills and smelters listed in Table No. 6 and 7 are shown on the map above. Irkutsk, in Siberia, with direct access to the Trans-Siberian Railway, will be the site of the world's largest alumina-aluminum works. Extensive deposits of nepheline are known to exist in the area and present Soviet plans call for several alumina-from-nepheline plants as well as reduction works in the area near Irkutsk (in the vicinity of the world's deepest lake, Lake Baikal). Irkutsk aluminum works, started construction in 1954, will have about 300,000 tpy design capacity.

Courtesy of Revue de l'Aluminium

Soviets Push Ambitious Aluminum Plans

F. H. BAER

THE VEIL of secrecy surrounding the post-war development of the Soviet aluminum industry has been lifted enough to give—probably for the first time—a close estimate as to the current production, and to forecast the hoped-for production for the next seven years.

Nikita Khrushchev's "Seven Year Plan" demands that the USSR become the world's biggest aluminum producer by 1965, utilizing the deposits of bauxite and nepheline which Peter Antropov (Minister of Geology and for the Conservation of Minerals) termed "the world's biggest".

NEPHELINE deposits in the Leningrad industrial district are shown on the map. These are being mined and processed to alumina using the flowsheet shown elsewhere in this article. Nepheline-derived alumina is used at Pikalevo and in part at Volkhov (the oldest of Russia's alumina works—1932).

High Output Planned

Rapid development of electric power output, especially in the Urals, the Siberian flats, and Central Asia is the basis, together with "abundant reserves of raw materials" to step up production from 46,800 metric tons produced in 1937 to 3,253,860 metric tons planned for 1965 (see table No. 1).

The high 1965 output may have

Mr. Baer is McGraw-Hill World News correspondent, Vienna, Austria

been set at this level because the USSR—the only East-Bloc country capable of producing enough aluminum to aid its European and Asian satellites—took it upon itself to become the sole East-Bloc aluminum supplier under COM-ECON rules. Hungarian, Czech, East German and Polish aluminum production is insufficient to cover domestic needs. With sufficient bauxite available only in Hungary, electric power shortage there forbids the all-out utilization of the raw material.

The Soviet plan figures for the post-war periods compare to the U.S. output as follows:

Table No. 1—Soviet Aluminum Production

Year	Crude aluminum in metric tons
1937.....actual output..	46,800
1940.....actual output..	74,412
1945.....actual output..	107,153
1950.....planned.....	214,306
1955.....planned.....	700,056
1960.....planned.....1,470,117	
1965.....planned.....3,253,857	

Table No. 2—Actual U.S. Aluminum Production

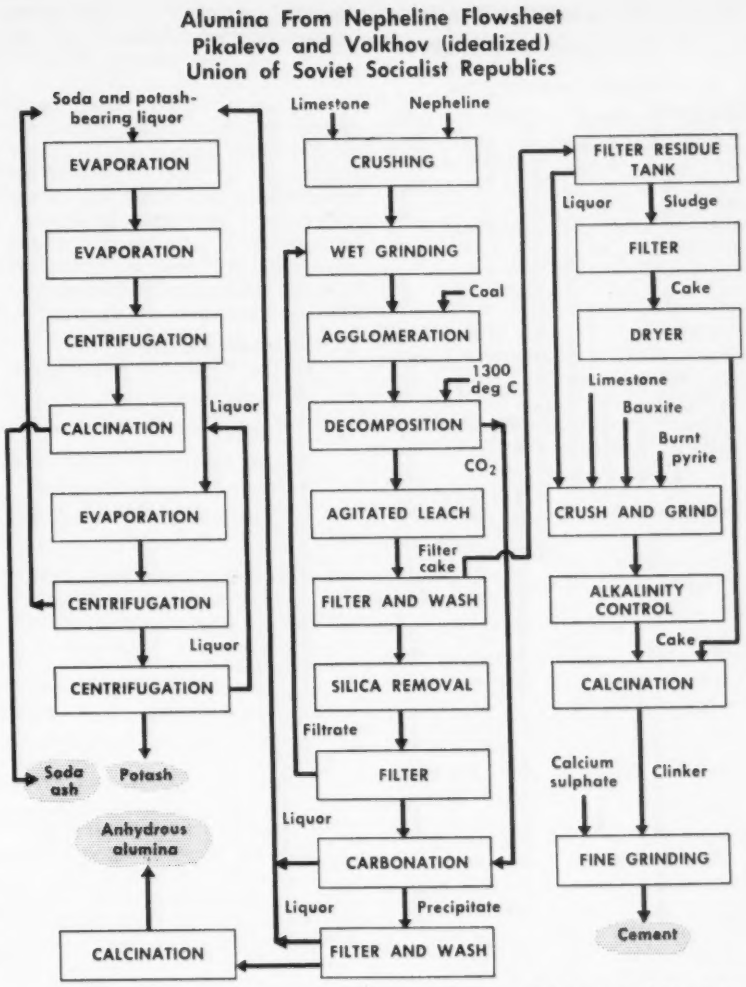
	Short tons
1939.....	164,000
1946.....	410,000
1956.....	1,679,000
1957.....	1,648,000
1958.....	1,557,000
1959 (primary capacity)..	2,209,250

Lenin's teaching that "Communism is the socialization of the country plus electrification" is clearly represented in all Soviet development plans for the national economy. The figures on the plans, and plan fulfillment, compared to the portion consumed by the aluminum industry are presented in Table No. 3.

Table No. 3—Russian Electric Generating Capacity

	Millions of kilowatt hours	For aluminum industry* %	For aluminum industry* Kilowatt hours
1937.....	36.4	2.16	770,560,000
1940.....	48.3	2.57	1,243,680,000
1945.....	49.5	—	1,799,555,100
1950-plan...	82.0	4.39	3,599,110,200
1950.....	90.0	—	no data available
1955-plan...162.0		7.21	11,690,905,200
1955.....170.1		—	no data available
1960-plan...320.0		7.67	24,550,953,900
1965-plan.....500 to 520.0		10.64	55,339,411,900

(*) An average consumption of 16,700 kwh per metric ton of aluminum has been used for working out power requirements.



Courtesy of Revue de l'Aluminium

NEPHELINE extracted from the deposits in the Kola Peninsula (see maps) is treated in the above flowsheet which starts with ore assaying about 30% alumina, 20% potash and sodium, 43% silica and 7% others. A slurry is made with limestone and ignited with fine coal to 650 to 1000 deg C in a kiln where the limestone decomposes, giving off carbon dioxide and forming lime which reacts at 1300 deg C with the nepheline to form a clinker composed of dicalcium silicates and water soluble aluminates of sodium and potassium. Silicates go to cement production and the alumina-bearing solution is autoclaved in an atmosphere of the carbon dioxide derived from the calcination of the limestone to precipitate the alumina as the hydroxide. A major reason for the economy of the process is said to be the production of three valuable by-products in addition to alumina—soda ash, potash and cement. The large alumina works under construction (since 1955) at Achinsk in Siberia will use this process to turn out 800,000 tpy of alumina for the three reduction works at Stalinsk, Krasnoyarsk and Irkutsk.

Khrushchev's "Control Figures for the Development of the National Economy from 1959 to 1965" foresees the 1965 electric power output to be 2.2 times over the 1958 level, whereas the aluminum industry is to increase by 2.8 times. As a result, the aluminum industry is to get a greater share of the total power output in 1965 than ever before.

One of the world's biggest aluminum plants is now under construction in Siberia. Located near Shelekhovo at the Irkut River (in Irkutsk district), it has direct access to the Trans-Siberian Railway. The first divisions were to go into operation at the end of the year 1958. The ultimate organization of the Irkutsk aluminum center—mainly fed electricity from the Brask hydroelectric plant at Angara River, the Irkutsk hydroelectric scheme at the Angara River which discharges into Lake Baikal, (Baikal is the world's deepest lake—5,712 ft) and the Krasnoyarsk

Table No. 4—USSR Exports of Nonferrous Metals

(Thousands of metric tons)

Metal	1955	1956	1957
Copper	36.7	52.4	60.6
Zinc	35.5	50.9	72.2
Lead	26.2	40.5	54.9
Tin	2.1	3.3	18.3
Aluminum	41.6	59.9	85.4

Source *Revue de l'Aluminium*

power-plant at Jenissei River—is to consist of three independent plants, one of which will be the world's largest unit.

The choice to locate the aluminum center in Siberia was prompted not only by the gradually rising output of electric power from the three schemes, but also by the availability of very large amounts of nepheline found in that district.

Nepheline ($Na_2O \cdot Al_2O_3 \cdot 2\ SiO_2$) ore is going to become the No. 1 aluminum raw material. The first information on the mastering of the process to turn nepheline into alumina along with such by-products as soda-potash and Portland-type cement was given by Pravda on April 24, 1957 when the awarding of a Lenin-Prize to I. Talmud, director of the Wolchov Aluminum Works, was announced.

Nepheline, which has about 50 to 67% of the alumina content of bauxite, is agglomerated with limestone. The extraction process which follows agglomeration yields alum earth, soda solutions, and mud. The soda solution is then processed into potash, the mud into high-grade Portland-type cement. Bauxite deposits are considered limited in the USSR, but nepheline reserves are "very large". The new processing method also proved advantageous as no soda has to be charged to the agglomeration, whereas all of the charged limestone is returned after agglomeration for cement production (see flowsheet).

However, new bauxite deposits were established in the south of the USSR. Shipments of alumina from the Urals district to the Sumgait aluminum plant (Azerbaijan) were stopped last summer when deposits were located near Kirovabad, also Azerbaijan S.S.R. The Zaglik mine is to be intensified to allow the new alumina works to process 1-million rubles ($250,000) worth of material per year.

Official Announcements Outline Importance of Aluminum

Nikita Khrushchev's plans for the nonferrous metals industry are outlined by his orders for the current Seven-Year Plan. Article 2 of the "Order for the Heavy Industry" states:

"The target figures provide for an increase in 1965 as compared to 1958 of the output of aluminum by approximately 2.8 times; copper by 1.9 times; while the output of nickel, magnesium, titanium, germanium, and silicon will increase considerably." The following verification of facts and figures are taken from published sources:

A) Aluminum production:

1) Output figure for 1937: Given at 46,800 metric tons
   Output figure for 1940: 59% over 1937
   Output figure for 1945: 1945 output was 144% of pre-war
   Plan figure for 1950: 1950 plan 200% of 1945
   SOURCE: U.N. document E/ECE/157, Geneva, February 1953
2) Output figure for 1955: Output of aluminum increased 2.8 times over 1950
   SOURCE: Statistics, State Planning Commission, *Tass*, April 24, 1956, Article 4 of chapter "Industry"
3) Plan figure for 1960: Plan envisages an increase by 2.1 times
   SOURCE: CPSU Draft Directives 6th Five-Year Plan, *Tass*, Jan. 15, 1956, Article 10, of chapter "Industry".
4) Plan figure for 1965: Raise the output of aluminum approximately by 2.1 times over the 1958 level.
   SOURCE: Khrushchev's "Control Figures for 1959 to 1965 Period" (Article 5 of chapter "Heavy Industry").

Important Note:

Since no data on the 1958 plan fulfillment (actual production) exists to our knowledge on this side of the Iron Curtain, the annual theoretical growth rate of the aluminum industry from 1955 to 1960 was added to the 1955 level to arrive at a 1958 figure. This theoretical annual growth rate would have been 154,012 metric tons. Added to the plan figure of 1955 (700,056 metric tons) were the three years of growth (total of 462,036 metric tons) to arrive at a 1958 total theoretical production of 1,162,092 metric tons).

5) Data on Nepheline: *Pravda*, Moscow, April 24, 1957 and *Angewandte Geologie* (East Germany) February 1958

B) Electric power production:

1) Electric power output 1937 through 1955: SOURCE: Sta-

Table No. 5—USSR Exports of Aluminum by Country

(Metric tons)

Country	1956	1957
Great Britain	5,300	17,500
Belgium	3,000	3,400
Bulgaria	500	800
East Germany	9,500	18,100
Holland	11,500	1,900
Poland	3,000	3,500
Roumania	4,000	5,000
West Germany	3,200	1,900
Czechoslovakia	12,500	20,000
Finland	2,000	3,100
Switzerland	3,300	700
Sweden	500	
Yugoslavia	1,000	1,000
India	500	
China	100	
Uruguay	39	
Total	59,939	76,900

Source *Revue de l'Aluminium*

Table No. 6—Installed Capacity of USSR Alumina Plants Planned for 1958 to 1965

Name of works	Capacity in metric tons
Achinsk	800,000
Boksitogorsk	150,000
Kamensk	350,000
Kirovabad	200,000
Krasnotourinsk	350,000
Pavlodar	500,000
Pikalevo	500,000 (?)
Vokhov	80,000 (?)
Zaporogie	200,000 (?)

Source *Revue de l'Aluminium*

Table No. 7—Installed Capacity of USSR Aluminum Plants Planned for 1958 to 1965

Name of works	1958	Planned 1965
	(Metric tons)	
Irkutsk	under construction	300,000
Kamensk	120,000	120,000
Kandalakska	25,000	25,000
Krasnotourinsk	120,000	120,000
Krasnoyarsk	under construction	400,000
Myski	under construction	?
Nadvoitsy	20,000	20,000
Pavlodar	under construction	250,000
Stalinsk	100,000	100,000
Stalingrad	under construction	200,000
Volkhov	45,000	45,000
Sumgait	20- to 30,000	50,000
Yerevan	40,000	40,000
Zaporogie	100,000	100,000

Source *Revue de l'Aluminium*

tistical Compilation on "The National Economy of the USSR", Moscow, 1956

2) Plan figure for 1955 and 1946 output: SOURCE: U.N. document E/ECE/157, Geneva, February, 1953 page 44.
3) Plan figure for 1960: "320-billion kwh" listed under "Basic Plan Tasks" SOURCE: CPSU Draft Directive, 6th Five-Year Plan, *Tass*, Jan. 15, 1956.
4) Plan figure on 1965: Electric power generation will increase up to 500 to 520 billion kwh, or by 2.22 times. SOURCE: Khrushchev's "Control Figures for 1959 to 1965 Period" (Article 5, "Heavy Industry").
5) Aluminum industry electric power consumption rate figured at an average need of 16,700 kwh per metric ton of crude aluminum.

General Remarks:

1) No plan fulfillment figures have been released for 1950 and 1955 on aluminum.
2) All figures for 1960 output (aluminum, electricity) have been scrapped at the occasion of the new 1965 plan target announcement, when the 6th Five-Year Plan was declared invalid in favor of Nikita Khrushchev's seven-year plan.

Kennecott Patents Columbium Flotation

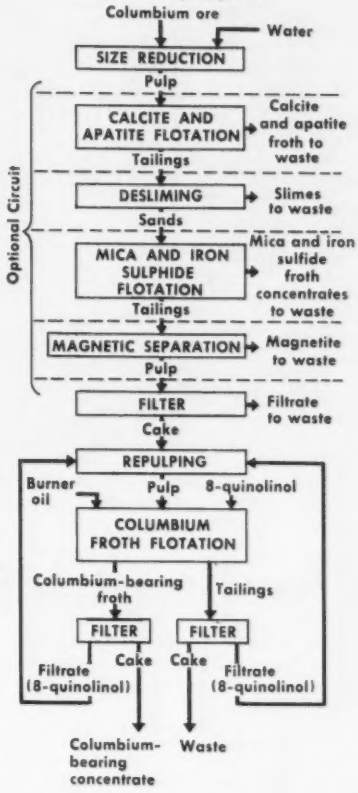
TWO METALLURGISTS at Kennecott Copper Corp.'s Salt Lake City, Utah research center have been granted a patent on the flotation of columbium-bearing minerals using a long-known standard analytical chemistry reagent —8 quinolinol—as the mineral collector. The patent states that in the opinion of the inventors—Arthur W. Last and Kent F. Marquardson—no successful flotation process exists in the literature to their knowledge.

Kennecott states that columbium minerals can be won in economic grades as high as 19.3% Cb_2O_5 with various members of the hydroxyquinoline family of organic chemicals. In accordance with the invention, crude ore is processed as shown in the accompanying flowsheet. If the optional circuit is omitted, concentrates grade about 1.3% Cb_2O_5; but using the optional circuit to upgrade the ore prior to the columbium float, concentrates of these approximate grades were produced from these reagents:

Collector	Grade Cb_2O_5
8-quinolinol	10.36%
2-methyl 8-quinolinol	9.21%
4-methyl 8-quinolinol	19.3%
6-methyl 8-quinolinol	5.59%

Of the reagents listed and tried, all are commercially available, although some only in reagent grade. Agitation and pulp aeration in the presence of the reagent, the use of commercial grade rather than reagent grade material, and the reclamation of the reagent in the filter effluent are cited as parts and advantage of the patent. U.S. Patent No. 2,875,896.

Floating Columbium Minerals
Kennecott Copper Corp., Salt Lake City, Utah.
Patent No. 2,875,896



French to Double Uranium Production by 1960

Location and Size of French Uranium Mills

Region	Mill	Annual capacity (metric tons) January, 1959	January, 1960	Grade of ore fed (metal)
Vendee				
Principal deposits: Ecarpiere, Chapelle Largeau, Commanderie	Ecarpiere(1)	300,000	300,000	1%
Limousin				
Principal deposits: Brugeaud, Margnac, Sagnes, Fanay	Bessines(2)	200,000	600,000	1.25%
Forez				
Principal deposit: Bois Noirs	Bois Noirs(3)		180,000	1.85%
Morven				
Grury	Gueugnon(4)	30,000	30,000	6%
	Total	530,000	1,110,000	metric tons

DURING 1958, actual French uranium ore production amounted to 426,000 short tons and is expected to reach a figure of 759,000 tons in 1959 in contrast to the somewhat lower estimates given in "Uranium" annual review, February 1959 E&MJ. The average grade of Metropolitan ore is 0.24% U_3O_8. Total ore reserves, as noted by J. J. Lecoq, director adjoint, Direction des Recherches et Exploitations Minieres, Commissariat l'Energie Atomique, have been estimated at 13-million tons of 0.1 to 0.3% U_3O_8 ore. M. Lecoq supplied the table.

(1). The first unit, with a capacity of 150,000 metric tons, has been in operation since April 1, 1957; the second unit, of equal size, has been in operation since Oct. 1, 1958. (2). The first unit, of 200,000 metric ton capacity, has been in operation since June 1, 1958; the second unit, of 400,000 metric ton capacity, will start to operate in Oct. 1, 1959. (3). Bois Noirs will go onstream by the end of 1959. (4). Gueugnon, in operation since 1954, converted to treat high-grade ore in 1955-1956.

THE OJANCOS MILL—built in 1936 and since reconstructed and enlarged—today has 250-tpd capacity, and soon will be able to handle 300. Unit contains a flotation plant, a 25-tpd sulphuric acid plant and two agitated slime leaching circuits.

Floating Chile's Oxidized Gold Ores

PART I

Fernando Benitez

WHAT DOES A NATION DO when faced with an economic crisis? How can the government find employment for the workers in a depressed economy? In the Depression, the U.S. encouraged the individual to mine gold. Chile did the same and provided gathering stations where the small miner could deliver his payload. And because these small odd lots came from so many different regions and ore bodies they proved to be a metallurgical headache.

Fernando Benitez, metallurgical consultant, Santiago, Chile, and a regular *E&MJ* contributor, was put in charge of the program to find and develop successful mill flowsheets to treat the mixed-up ores.

The serious world crisis of 1930-1938 had near catastrophic economic, financial and political repercussions in Chile because that country's economy depended almost exclusively on the export of copper and sodium nitrate. While during 1929 and 1930 Chile produced 3.6- and 3.3-million tons of nitrate, output had fallen to 1.2-million tons by 1932, and the value of the fertilizer fell from $38 in 1928-1929 to $20.

The price of copper spiralled down from 18c in 1918 to less than 5c in 1932. As a consequence, Chilean exports of copper fell from 334,000 tons in 1929 to 105,000 tons in 1932 and the labor force in the copper mines was reduced from 21,000 to less than 7,000 men.

Chilean exports fell from $130-million to $7-million from 1929 to 1932—a reduction of 95%. Meanwhile, the gold reserves of the Central Bank decreased from $62- to $19-million in the same period. The number of unemployed rose to 150,000 men, a considerable proportion of the labor force. The copper and nitrate mines and plants were compelled to fire 80% of the men employed.

The value of the U.S. dollar rose from 8 to more than 60 Chilean pesos—today the dollar is worth 1,125 Chilean pesos—1/140 of its 1929 parity.

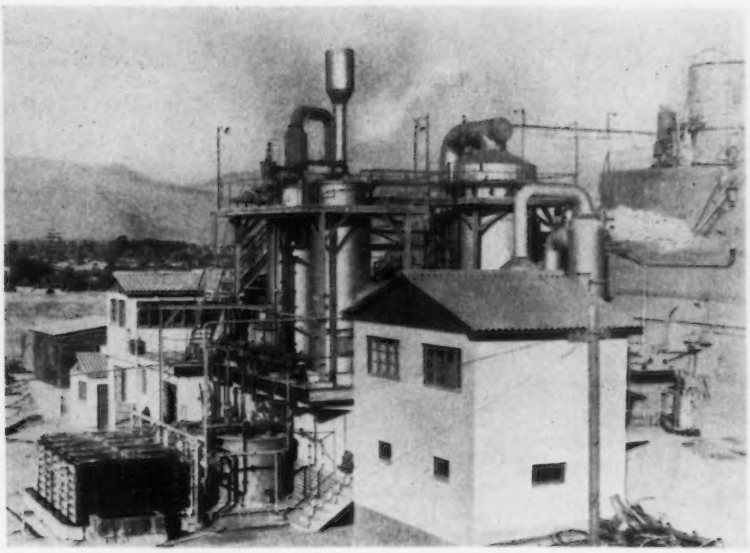
And the value of a gram of gold rose from 5½ pesos to more than 40 (1 troy oz equals 31.103 grams). Hard currencies were almost unobtainable and in order to get foreign exchange and give useful work to the large number of unemployed, the government did everything possible to augment the production of gold from mines and placers.

In 1930 the government, through the Mining Credit Bank, built three 110-tpd copper flotation mills in the most important copper camps of northern Chile, but very soon after going on stream found the three mills without any ore, since no small mine could then (or now) produce the red metal at 5c per lb market price. To keep the new mills operating, produce foreign exchange, and give useful work to the unemployed, the Mining Bank started buying low grade ores from the mill's neighboring mines.

Here are the metallurgical problems encountered, and the results obtained by the Chilean mineral processing engineers as they fought to ease the burden of the Depression among their people.

Mr. Benitez is a metallurgical consultant, Santiago, Chile.

FLOTATION of the oxidized gold ores of Chile presented far greater difficulties than those of the sulphides of the base metals, such as copper, lead and zinc or those in which the gold is associated with pyrite or chalcopyrite or both. They are also more difficult



ACID PLANT at Ojancos in Copiapo is a Lurgi contact design. Adsorbing and drying towers, the top of the converter and the circulating tanks are in front.

to float than most of the non-metallic minerals.

Gold in the ores is finely disseminated and therefore they must be ground to at least 80% minus 200 mesh.

Flotation of the gold contained in the ores is slow. At least a 30 minute flotation time is required.

Experience shows that intensive mechanical agitation is also a requisite for a good recovery and that this can be best carried out in Denver or Fagergren machines. After these, to complete the flotation time required, air cells might be placed in the circuit, though over the years the author became absolutely certain that an all mechanical agitation circuit is best. We were compelled to use air cells because of lack of funds to buy mechanical machines. The Forresters were always used as scavengers.

Extensive and thorough testing over a long period of years proved that steam distilled pine oil alone or in combination with Aero Promoter 712 were the superior frothers. At that time none of the modern frothers such as Dowfroth 250 and Aerofroth 65 were in the market.

As far as collectors are concerned, by far the best and most consistent results were always obtained with Aero Xanthate 301 (sodium secondary butyl xanthate) though with some ores the addition of a little Aerofloat 208 Promoter was a help. When it is difficult to form a persistent froth with pine oil, creosote from the distillation of coal is added as a stabiizer.

The pH seems to have little influence, and we always found that it was best to float with the pH given by the water used at the different mills, which was slightly above 7. An exception was the Punitaqui Mill.

None of the modifying agents tried out, such as Na_2CO_3, NA_2S, $CuSO_4$, Na_2SiO_3, caustic starch, etc., proved beneficial. CaO was beneficial in the flotation of the Punitaqui ores in spite of all that has been said by many U.S. flotation men and especially in the work carried out by the U.S. Bureau of Mines. Lime does not depress gold at all!

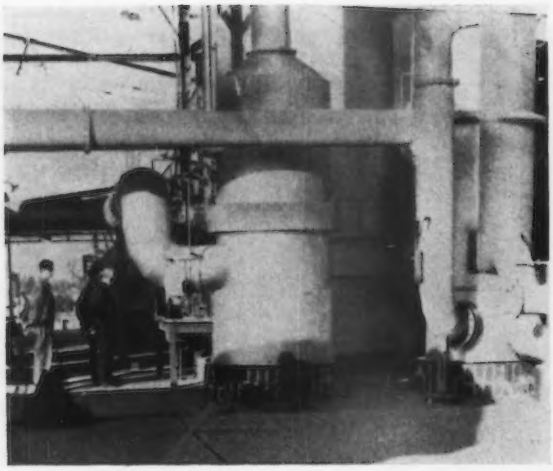
In a large number of cases in which corduroy tables were tried out over long periods on the flotation tails, it has not been possible to reduce their value by this means and the grade of the concentrate obtained was only slightly higher than the grade of the tails. Many other types of surfaces were tried, as well as other gravitational concentration methods such as jigs, tables, etc., but all led to failure. (With some ores it has proved beneficial to place jigs between mills and classifiers.)

Some years ago it was proposed to submit the flotation tails to a leaching operation with H_2SO_4 to get rid of the copper; to neutralize the thickened pulp with CaO as protective alkali and then cyanide to recover the gold, but careful estimates proved that with tailings running less than 0.13 oz of gold per ton, the operation is a dead loss with gold pegged at $35 per oz on account of high cost of H_2SO_4 and NaCN in Chile.

Conscientious study proved that there is no relation whatever between the oxidized copper minerals which Chilean gold ores carry and gold it-

AMOUNT of lime used reaches as much as 17.6 lb per metric ton, due to varying quality of the lime and, to get pH 9.6.

COPIAPO in the background of the acid plant cooling towers is the capital of Atacama Province, population 30,000.



HEAT EXCHANGERS of the sulphuric acid plant cool the SO_3 coming from the converter, and heat the burner air.

SAN FRANCISCO and Carmen Alto, where the Hochschild company is developing a lot of ore, are old mine properties.

self. The copper minerals carry very little or no gold.

The author wishes to lay stress on the fact that the success attained in the flotation of Chilean gold ores was due to a combined effort in which many Chilean mill men collaborated in a most selfless effort.

Among these engineers, the author must single out for their outstanding work C. Neuenschwander, R. Fritis, E. Kausel, G. Reyes and H. Garcia.

The gold ores being exploited at that time were mined from gold, gold-copper and gold-copper-silver veins, some recently discovered but the majority known from the time of the Spaniards.

The Chilean gold veins are located in their greatest number in the Coast Range and in the low hills of the Central Valley. So far few gold mines have been found in the Cordillera. According to Señor Hector Flores, professor of economic geology, University of Chile, the greatest number of the veins are related to the granodiorite intrusions which took place between the upper Cretaceous and the lower Tertiary and the rest is related to rhyolite lava flows of Miocene age.

In general it may be stated that about half of the gold veins are found within the granodiorite intrusions and the other half in country rock.

Gold ores coming from the veins were characterized by the fact that most of them came from the oxidized zone, a much smaller portion from the zone of secondary enrichment and only a very small portion from the primary zone (which in the greatest number of the Chilean mines is far too poor in grade to be exploitable).

In contrast with the gold deposits of the Witwatersrand, those of the Kolar gold field in Mysore and St. John d'el Rey mine in Morro Velho, Brazil and with numerous gold mines of Canada and the U.S., the gold veins of Chile only reach shallow depths, the greatest profitable depth of any gold deposit being that of Las Vacas (about 1,000 ft) in Illapel, Coquimbo province, some in Altamira (Taltal) and El Morado (Vallenar).

The most important gangue mineral is quartz, generally drussy, but in some of the veins hematite replaces quartz in importance. In the oxidation and secondary zones practically the whole of the pyrite has been altered to limonite. Ores of the oxidized and secondary zones carry, besides limonite, appreciable quantities of secondary minerals such as kaolin, clays, and chlorite.

Gold is generally found very finely subdivided, and a considerable part of it lies within the limonite. A great deal of the yellow metal is "rusty" which makes it very difficult to float. Even the small amount of pyrite encountered is partially tarnished and hard to float.

Another serious disadvantage of most of the gold deposits is that they contain appreciable amounts of oxide copper. This unhappy circumstance had a very considerable influence in the method of beneficiation adapted, since cyanidation was out of the question.

The oxide copper minerals found in the veins were chrysocolla, malachite, azurite, atacamite, the oxides and calcanthite. Most copper minerals dissolve very rapidly, causing high cyanide consumption, making precipitation of the precious metals difficult unless the pregnant solutions were rich in CN; and produced low grade Au-Ag precipitates due to the copper.

Moreover, the financial situation of the Mining Bank at the time was such that it was not possible to build new cyanide mills or add cyanide sections to the three flotation mills already constructed. Also it was impossible to foresee the development and growth that gold mining might take, and consequently the Bank's Board came to the only conclusion possible under the circumstances — treat the low-grade gold-copper ores in the three existing mills which had been designed for the flotation of sulphide copper ores on the desert.

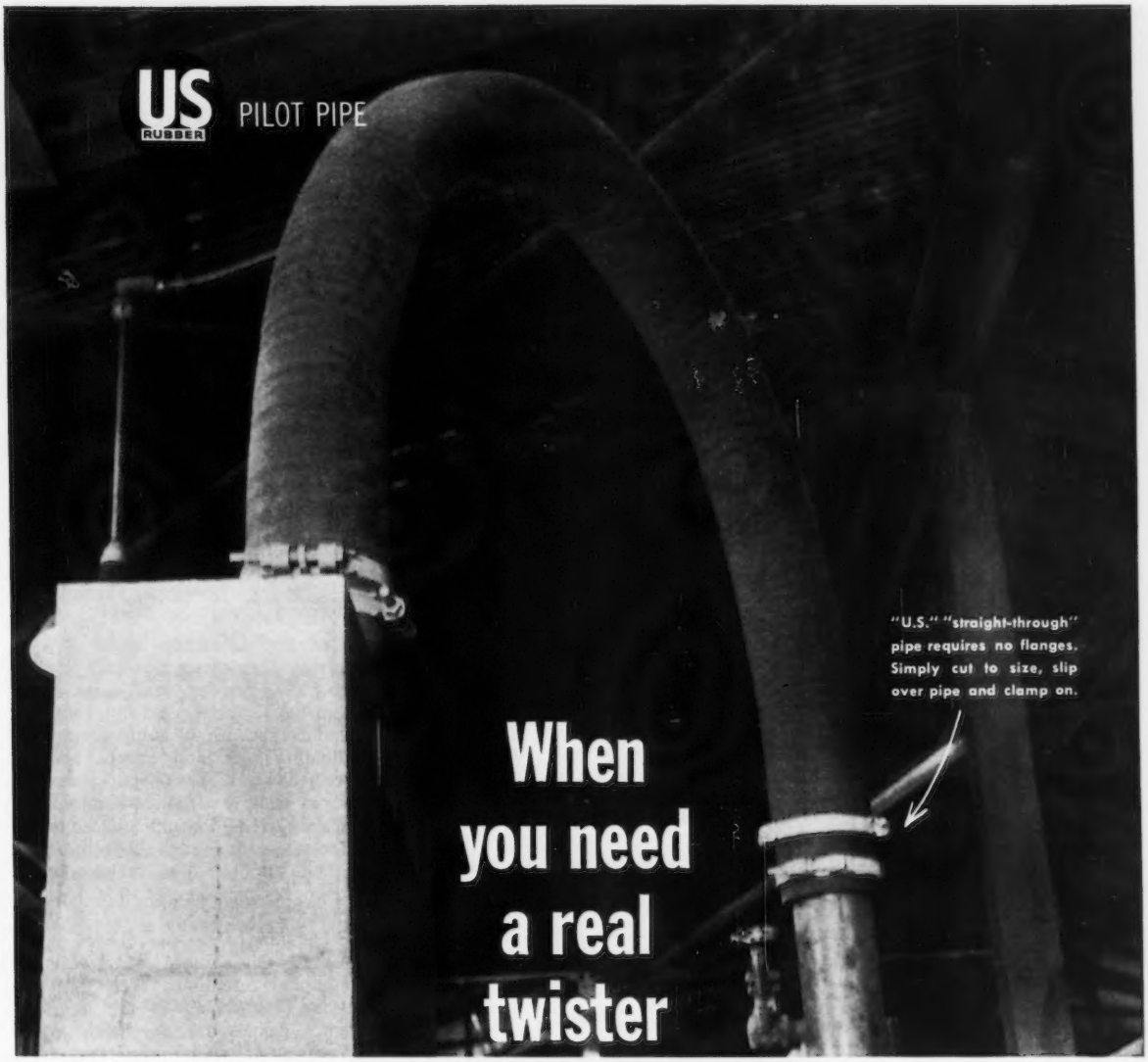
A thorough research was made in the existing literature on flotation of oxidized gold ores and was found to be extremely scanty. Moreover, that which was found was not encouraging. As Professor Taggart in his first edition (1927) said, p 866:

> *"When the precious metals are intimately associated with the sulphides of the base metals, or the precious metal is a sulphide or is found in the metallic form and sufficiently subdivided and is found in a sufficient quantity or with a sufficient quantity of the sulphides of the base metal sulphides to establish the froth, flotation can be used and a good recovery obtained."*

In the new edition of the famous text published in 1945, Professor Taggart corrected himself as is well known by those readers familiar with his discussion of the difficulties encountered in gold flotation on p 12-117.

Therefore it became imperative for those mill men who were entrusted by the Bank with the flotation of the oxidized gold ores to start right from the grass roots, just as the majority

Results Obtained in the Bank's Mills During the Years 1934 to 1944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Results Obtained in the Bank's Mills During the Years 1934 to 1944 In the Flotation of Oxidized Gold Ores

	Ore			Concentrate					
Year	Metric tons	Grade oz/ton	Fine gold contained	Tons	Grade oz/m ton	Fine gold contained	Gold from amalgam	Total gold recovered	Recovery per cent
1934	74,797	0.484	36,300	2,817	4.42	12,439	8,981	21.420	59.2
1935	51,970	0.500	25,800	2,850	6.32	18,008	172	18.180	70.0
1936	24,090	0.464	11,600	848	10.90	9,243	—	9.243	79.5
1937	35,020	0.500	17,500	2,083	6.59	13,690	—	13.690	77.9
1938	37,368	0.468	17,400	2,569	5.28	13,616	—	13.616	77.4
1939	47,615	0.502	23,900	3,676	5.03	18,498	—	18.498	77.1
1940	53,194	0.536	28,500	4,951	4.55	22,559	—	22.559	79.0
1941	60,631	0.530	31,300	4,564	4.67	21,246	2,538	23.784	75.9
1942	34,070	0.580	19,800	3,867	3.54	13,689	2,078	15.767	79.7
1943	27,372	0.583	15,900	3,699	3.05	11,282	1,140	12.422	78.4
1944	27,146	0.598	16,200	3,052	3.60	10,987	1,615	12.602	78.1

of the Chilean gold mines of those days would have started—if there had ever been any kind of grass in the Atacama Desert, where most of the mines were located.

Mathematically speaking, the quantity of gold to be floated when compared with a 3% chalcopyrite ore was absolutely pitiful, about 20 parts in a million against 30,000; but the first flotation tests carried out in laboratory machines proved that the oxidation products of the gold veins such as limonite, kaolin, talc, clay, etc. had a great tendency to float, against what Taggart had assumed, and would, when suitable reagents were used, form stable, though dirty, forths in which an appreciable quantity of the gold (60 to 70%) was recovered in a concentrate which varied between 3 and 9 oz of gold per ton.

However, the laboratory testing as well as the treatment of the first lots of gold ores proved that the results were extremely erratic both as to recoveries and grade of concentrates, those having very talcose and argillaceous gangues being the most difficult to treat. Moreover, it must be remembered that when we speak of such kinds of ore—talcose for example—we cannot speak of a certain "type" of ore, since at the Mining Bank's mills the ores milled were made up of a large number of ores from many mines.

One peculiar characteristic of the small copper or gold mining industry of Chile is that output of hundreds of thousands of tons of low grade ores is obtained from numerous small mines which deliver many tiny lots of ores to the Bank's buying agencies, and which are afterward blended prior to treatment in the mills. To give an idea of how small this kind of mining can be and still is, one of the most important of the agencies bought an average yearly weight of less than two tons.

Under such conditions, it can be understood why the Bank was compelled, for simple economic reasons, to blend the ores as they were bought and sent to the mills for treatment whatever their origin, composition or grade. We metallurgists were left to find the answer to the problem since to blend according to types was a hopeless task with 40 agencies buying along 2,000 kilometers of territory in smaller than two ton lots.

When we began the flotation of these intricate mixtures of gold ores, the same reagents were employed in the flotation of the copper ores, that is: G.N.S. No. 5 pine oil as a frother and K-etyhl xanthate or Aerofloat 25 as a collection.

It has already been mentioned that there never was any difficulty in forming stable froths though the thickness of such froths seldom was more than half an inch. Another characteristic of the froths was their relative instability compared with the froths obtained with copper, lead and zinc; as well as the fact that the average diameter of the bubbles was only a few millimeters.

Instability of the gold froths soon made a creosote obtained from the Santiago Gas Works very popular at all of our gold mills as a froth stabilizer. If used in excess it would reduce the concentrate grade but in due amount it would produce a very stable and workable froth which it was impossible to obtain either with pine oil or Aerofloat 25. The creosote also produced larger bubbles.

The composition of this creosote was:

Phenol	10%	
Cresols and xylols	20% to 30%	
Pyridine and quinoline	5% to 5%	
Olefines	14%	
Aromatics	31%	
Parafines and naphthenes	20% to 65%	
	100%	100%

Density: 0.91 to 0.92

The reagents were added—pine oil and creosote to the ball mill and the Aerofloat 25 and the xanthate to the classifier overflow.

Mixed Oxide-Sulphide at the Ojancos Mill

Owing to oxidized and sulphide zones in the Ojancos mine not being well defined because of its topography —undulating hills, and, maybe also due to geological reasons not ascertained, as well as the exploitation system employed—the mill was compelled to treat simultaneously both the oxide and sulphide ores, which did not make beneficiation of this feed any easier.

The blending of the two classes of ores varied considerably from week to week and oftentimes even from day-to-day, but owing to the large experience gained by the author in the treatment of the far more varied blend of the Milling Bank's mixture of ores that literally come from hundreds of different mines, the milling of the mixed oxide-sulphide ores coming from a single mine did not offer unsurmountable difficulties.

Ores from the oxide zone contained a certain proportion of partially altered sulphides such as pyrite, chalcopyrite, sphalerite and a small quantity of chalcocite. The gangue was mainly composed of quartz, orthoclase, kaolin and limonite from the decomposition of the pyrite. The gold was mainly free but a small portion was contained in the pyrite. Copper in the oxidized ore occurred mainly as chrysocolla, malachite, azurite and some atacamite.

The sulphide ore carried: pyrite, marcasite, pyrrhotite, chalcocite and sphalerite in the order given, as well as small quantities of native gold and copper.

A partial analysis of the ores was:

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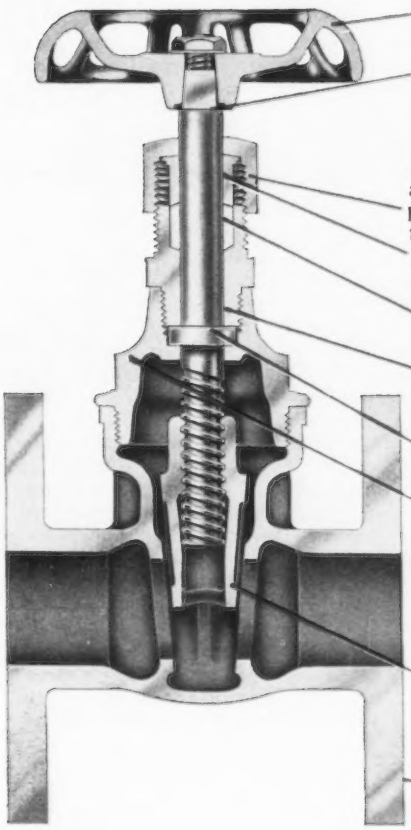
SEND FOR NEW CATALOG of Jenkins Stainless Steel Valves, in patterns and alloys that satisfy the requirements of practically all corrosive services. These Jenkins Valves meet valve industry specifications and the high standards established by leading users of stainless steel valves.



WHEEL of high strength malleable iron, designed for firm, cool grip and easy operation.

SPINDLE of large diameter and dense structure has high resistance to wear and torsion strains. The threads precisely machined to correct pitch and lead assure tightness, ease of operation and resistance to shearing stresses.

PACKING NUT is strong and deep for full thread engagement.

PACKING GLAND is a self-centering design to afford tightness without excessive friction on spindle.

PACKING — A Teflon ring in a large capacity box requires less frequent replacement.

PACKING BOX NIPPLE assumes thrust when closing valve. It is extra heavy, with hex flats larger than diameter of bonnet face to prevent leakage.

SPINDLE COLLAR, integral with spindle, is large and wide to resist thrust and shearing strains.

BONNET is a rugged unit, with accurately machined threads to assure tight joints with the body and packing box nipple. Top of wedge and corresponding face inside of bonnet are machined to insure perfect spindle alignment and backseating for repacking valve under pressure.

SOLID WEDGE is tapered equally on both faces. Lugs on sides of wedge engage guide ribs in body to reduce drag and minimize chatter.

BODY has best combination of wall thickness and shell design to withstand pipeline stresses. An integral seat minimizes corrosive attacks.

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	Percent in oxide	Percent in sulphide
Total copper	0.60	1.39
Oxide copper	0.35	0.21
Fe	10.52	16.80
Insoluble	79.47	61.00
S	0.20	15.90
Zn	0.05	0.20
Pb	trace	trace
Au	0.41 oz	0.51 oz
Ag	0.20 oz	0.13 oz

The laboratory test work carried out in Chile and in the U.S. proved the need of fine grinding, of the order of 80% minus 200 mesh to be able to do a differential separation and to obtain a satisfactory gold recovery, since the metal was finely disseminated through the gangue.

From the beginning it was easy to obtain a satisfactory recovery of the payable metals — gold and copper — with a bulk flotation, but the grade of the concentrate was low both in gold and in copper, which meant a considerable expense in freight, smelting charge and bags. At that time the Paipote smelter was not built (Paipote is only 5 miles from the Ojancos mill). For this reason differential flotation was tried out in the laboratory by the author with great success.

When differential flotation was tried in the mill it was immediately proved that the standard rake classifier was not satisfactory to obtain a grinding of 80% minus 200 mesh (0.074 mm) and for this reason a Dorr bowl classifier was installed in series with the standard. Overflow from standard was pumped by a Wilfley pump to the bowl.

Overflow from the bowl went to the conditioner and the sands back to the scoop-box of the ball mill.

The following table shows the results obtained with both classes of treatment:

Heads
0.38 oz Au, 1.35% Cu (bulk); 0.39 oz Au, 1.42% Cu (differential)

Concentrate
1.73 oz Au, 7.1% Cu (bulk); 4.0 oz Au, 24.2% Cu (differential)

Tails
0.071 oz Au, 0.29% Cu (bulk); 0.077 oz Au, 0.28% Cu (differential)

Recovery
Au 85%, Cu 81.9% (bulk); Au 82%, Cu 81.5% (differential)

Grinding to minus 200 mesh
80% (bulk); 81.9% (differential)

Ratio of concentration
Au 5.55:1, Cu 6.43:1 (bulk; Au 12.7:1, Cu 21:1 (differential)

It will be noticed that when the grade of the concentrate was raised from 1.73 to 4 oz per ton, the tails only increased by 0.006 oz per ton. This small increase in the loss of gold in the tail was more than offset with the savings obtained in freight and smelting charges. The concentrate was at the time being shipped to the U.S.

The reagent combination used at the Ojancos Mill was:

Reagent	Grams/ton	Added at
Pine oil G.N.S. No. 5	88	Ball mill
Aerofloat H	22	1st Fagergren
Aero Xanthate 301	56	Conditioner
Aerofloat 208 Promoter	56	Conditioner
NaCN	440	Ball mill
CaO (maximum)	8000	Ball mill

The amount of CaO used reached as much as 17.6 lb per metric ton because the quality of the lime was poor and varied from one shipment to another. It was regulated so as to obtain a pH of 9.4 to 9.6 though at the beginning a pH of 11 was used. However, it was proved that with a 9.5 pH and 1.0 lb per ton of NaCN it was possible to depress the whole of the pyrite, and the grade of the concentrate in copper sometimes exceeded 30%.

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To be continued next month as Part II, containing details, data and the flowsheets established at Domeyko, Punta del Cobre and Punitaqui.

Impregnated Fabrics Collect Fluoride Fumes

CLOTH DUST COLLECTORS, chemically treated with adsorbing materials, are proving useful in decreasing air pollution from gaseous fluorides in stack discharges. The filters can be used by the iron and steel, ceramic, fertilizer and aluminum smelting industries with high efficiency and moderate equipment cost.

The efficiency and low cost of the adsorption process permits its use for elimination of concentrations of gaseous fluorides previously considered too low for economic treatment.

Use of chemically treated dust collectors, such as Wheelabrator Dustube collectors manufactured by Wheelabrator Corp., Mishawaka, Ind., for collecting solid reagent material containing undesirable contaminants, has made it possible to remove up to 99% of gaseous fluorides contained in industrial gaseous effluents.

In the process, contaminants first contact finely pulverized solid adsorbing reagents introduced into the duct or flue system. Gaseous fluorides have an affinity for the adsorbing reagents. The reaction progresses rapidly and comprises both surface adsorption of the contaminants and chemical reaction in which stable chemical compounds are formed. Removal of the solid particles from the gas stream by cloth filters also removes the fluorides they carry. The fluorides are principally hydrogen fluoride, silicon tetrafluoride and hydrofluosilicic acid.

Over-all efficiency is improved by the treated cloth in providing additional intimate contact between the reagent material and gaseous contaminants as the gas being filtered moves through layers of partially spent and unreacted reagent on the collecting surfaces.

Contaminants are thus given a second contact with reagent material under favorable conditions as gaseous effluents pass through the built-up layer of powdered reagent on the filter cloth. Cyclic removal of spent reagents from the filter cloth followed by replacement with new material from the gas stream makes the process continuous.

In some instances, a reagent may be selected which will permit the later regeneration and recovery of the fluorides for purification and eventual marketing. In other cases, raw materials from the process itself may be used as adsorbents and then returned to the process.

The extreme activity of gaseous fluorides permits a wide selection of adsorbing materials. These include pulverized limestone, lime, clay, dolomite, alumina and various hydrates of alumina.

Proper selection of reagents will control, within rather broad limits, the proportion between surface adsorption and chemical reaction of gaseous fluorides with the reagent itself. Generally, the finer the particles, the more effective the process, because surface area determines rate of reaction and amount of material which can be removed.

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B.F.Goodrich Rock Service tires give coal company 30,000 miles before retreading

UTILITY COAL COMPANY operates a strip mine near Marion, Illinois. 25,000 tons of coal a month are hauled from pit to tipple over rough roads pocked with holes and large rocks. For this rugged work, Utility chooses B.F.Goodrich Rock Service tires—and no wonder. One set went 30,000 miles before retreading, has gone 8,000 miles since and has thousands of miles yet to go. Rock Service tires have minimized road delays, given maximum traction.

The Rock Service tire has a double chevron tread that grips the road in forward or reverse. The tread is specially compounded to resist rock cuts and bruises. And under the tread is the B.F.Goodrich FLEX-RITE NYLON cord body that withstands double the impact of ordinary cord materials, resists heat blowouts and flex breaks. This is why the B.F.Goodrich FLEX-RITE NYLON cord body outwears even the extra-thick Rock Service tread, can still be retreaded.

If you want better tire service at lowest cost per mile, see the money-saving tires your B.F.Goodrich Smileage dealer has for every type of mining job. Look for your B.F.Goodrich dealer's address under Tires in the Yellow Pages of your phone book. *B.F.Goodrich Tire Co., A Division of The B.F.Goodrich Co., Akron 18, Ohio.*

Enter the B.F.Goodrich Truck Tire Mileage Contest. You can win a Thunderbird or Corvette or one of 310 other prizes. See your B.F.Goodrich dealer for entry blanks.

Specify B.F.Goodrich Tubeless or tube-type tires when ordering new equipment

B.F.Goodrich *truck tires*

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CARS ARE AIR-HOISTED up the 1,000-ft shaft, pulled up portal embankment, and then side dumped into a steel-lined timber muck bin which empties into trucks.

SLUSHER RAMP (12-ton, 40-ft long) was installed just behind tunnel face.

Hull Changes Drilling Direction to Rework an Old Iron Mine

BY CHANGING the direction of its digging, Hull Iron Mines Ltd., in southwestern Quebec, has turned a long-unworked open pit into a profitable operation.

The company is carrying out extensive development work beside a 3-million ton iron ore deposit at Ironside, about three miles northwest of Hull.

When diamond cores showed an ore body approximately 600 ft long, between 15 and 100 ft wide and more than 400 ft deep, containing at least 15% iron, Hull decided to drive a 15-deg, 800-ft incline which drained the underlying ore body and got specimens for mill tests. Preliminary plans called for a crushing plant at the 200 level with crushed ore moving to the surface by a conveyor in the 800-ft incline.

In May, 1958, Dravo of Canada Ltd., Toronto, began sinking the incline, and is now at the 100 level. Development work has been carried out on the 200 level and the old workings have been drained and cleared.

Diamond drilling and preliminary metallurgical analysis indicated that the ore from the 400 level would be more saleable than that from the 200 level. On the basis that the 400 level ore would be mined first and with the promise of ore below the 500 level, Hull decided on a change in development.

As a result, Dravo has been awarded a contract to sink a three-compartment shaft from the 100 level to the 480 level. Ore pockets will be installed between the 100 level and the surface (at plus 65) and a crushing plant is proposed for the 100 level to crush and blend ore from the 400 and 200 levels before sending it to the surface by conveyor for shipment to the steel mills.

In addition to sinking the shaft, Dravo will drive a cross-cut to the ore at the 400 level to allow further diamond drilling from that point to outline the ore body above and below the 400 level.

Dravo sank the first incline, which was 18 ft wide by 12 ft high, using the standard sequence of drilling, blasting and mucking, with the muck being loaded directly into trucks at the mine portal by a 25-hp slusher. After the passage was driven about 150 ft the slusher remained at the tunnel face and loaded into rubber-tired mine cars pulled by a D-8 Caterpillar tractor.

This process eased installing a 12-ton, 40-ft long steel slusher ramp just behind the tunnel face. Built in two pieces at Dravo's Deseronto, Ontario yard, the ramp was bolted together at the site and skidded down the incline by tractor. The slusher pulled the muck up this ramp and dumped it into the cars through an opening in the ramp. The cars, which weigh about three tons empty and ten tons full, were then pulled to surface and side dumped into a steel-lined timber muck bin, from which the trucks were loaded.

When the work had progressed to a point about 300 ft from the portal, ventilation problems with the tractor made it necessary to use an air hoist on surface to pull out the mine cars. The hoist, a single-drum Lambert with an 8000-lb rope pull, was set up on an embankment directly in front of the portal, 30-lb rails were laid to the slusher ramp, and the mine cars' rubber tires were replaced with flanged wheels.

To remove smoke from the tunnel, Dravo first used a 5-hp fan. However, as the shaft was lengthened, a 15-hp fan was substituted to meet the increased ventilation requirements.

The new shaft will be constructed by first driving a vertical raise from the 100 level through to the surface (a distance of some 165 ft) and then sinking the shaft from the 100 level to the 480 level by standard shaft sinking operations.

The shaft will consist of two 6x6-ft skip compartments and a 5x6-ft manway. Shaft sets of 8x8-in. local timber will be installed at 7-ft intervals and the standard items of ladders, landings, vent pipe, air line, water lines and electrical cables will be installed in the manway compartment.

Dravo will install a 60x60-in. Canadian Ingersoll Rand double-drum electric hoist on surface to carry out the shaft sinking and future development work. Because the shaft is being sunk from the 100 level, the raise above this level will act as a headframe to house dump doors and muck bins. This will allow placement of the sheave wheels for the hoisting cable in a concrete collar right at ground level, thus eliminating a costly timber headframe and muck bins.

Shaft muck will be stored in the 6x8x90-ft muck raise driven upwards from the No. 1 incline and will be hauled to the surface and dumped at regular intervals by the incline car and air hoist used in the incline driving. After shaft sinking has been completed, the muck bin will be enlarged to act as an ore storage bin, and a conveyor will be installed to move the crushed ore from the 100 level to the surface via the incline.

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LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

OPERATING IDEAS *(Continued)*

These Easy-to-Follow Hints Can Reduce Truck Lubrication Costs

THE FOLLOWING truck lubrication hints appeared in the October 1958 issue of Le Tourneau-Westinghouse's Earthmover News.

"The first rule is to see that when a lubricant is applied, it is in the same condition as when it was bought. Many things can happen to it between delivery and application. Such things as careless handling, contamination, confusion of brands, exposure to extreme temperatures, and leakage, can result in damaged equipment, excessive maintenance costs, and lost production time."

Lubricants should be stored in a central location so that hauling distances are as short as possible. Indoor storage is best, but if the drums are stored outside, they should be placed on their side, and on racks. If the drums are placed upright, rain water may accumulate and be slowly sucked into the container by normal breathing action.

"Storage areas should be clean, whether indoors or out. And orderliness is a *must*. By keeping different brands and types of lubricants separated and in their proper places, there is less chance for confusion and error.

"Whenever possible, apply the lubricant directly from the original container. Eliminating 'transfer' containers cuts down the chances of contamination."

LeT-W said that the key to the actual lubrication procedure is to set up a definite schedule and stick to it strictly. For example, if the operator finds that the interval between lubrication changes can be increased a certain amount "with no harm done," the natural tendency is to extend it further and further until the machine may be permanently damaged. To be sure that lubrications are kept on a steady schedule, operators should keep accurate records. "A few check marks on a printed form are all that's required."

The last, but by no means the least, point covered by Earthmover News was that equipment should always be cleaned before lubricating. Cleaning will accomplish two things: it will uncover lube fittings that might be caked with dirt and thus forgotten; and it will reduce the chance that dirt might contaminate the lubricant as it is being applied.

Earthmover News summed up the article with four main suggestions:

- Use a simple plan and keep the number of lubricants to a minimum
- Store and handle lubricants in accordance with established practices
- Apply lubricants properly
- Establish a lubrication program and follow it to the letter

Precipitate-Forming Gas Prevents Water Seepage in Drill Holes

A WATER-SEALING TECHNIQUE for air-flush drilling, in which a gas is used to produce a pore-sealing precipitate in the ground water, has been developed by Gulf Oil Corp.

Drilling is both faster and more economical when air or gas is used as a circulating medium rather than water, mud or other liquids. Unfortunately, wet ground fouls the operation. Gulf says that previous unsuccessful or uneconomical shut-off attempts included forcing in plugs with explosives and injecting gelatins, fluid plastics, or combinations of chemicals.

The new Gulf scheme solves the problem by first isolating a well's water-producing zone by means of packing above and sometimes below it. In the first of the new processes, a chemical liquid and then a gas are pumped down under pressure, one after another, into the isolated zone. In the second and improved process, only gas is injected.

In either case, gas fingers its way through the fluid (whether chemical or water), mixing and reacting as it goes. A precipitate thus forms in the sand as far back as the gas is able to penetrate. When pressure is relaxed and the water mass presses back against the seal, it packs the material tighter, increasing the plugging action.

The seal proved 99% to 100% effective in field trials against water flow varying from two to 2,200 gph.

Commercially available gas and very simple equipment are used with the latest process.

Soviet "Mole" Can Bore 32 Feet per Hour

BULLET-SHAPED "MOLE" that drills through hard and soft rock has been developed by the USSR, according to the Vienna bureau of McGraw-Hill World News.

The tip of the Soviet machine has four ground-breaking cutting edges. A metal spiral, wound around the body's center third, moves loose material to the rear, where four "legs", which look like ordinary engine valves, push it further back and away from the borer.

The whole apparatus spins along its length axis at 300 rpm, cutting its way as it advances 32.81 ft per hour. The Russians, however, did not disclose the power source for the machine.

The first units have been used in the Kutsnesk Basin (coal), though Soviet engineers now claim to be developing other types for more varied mining operations.

SEND US YOUR OPERATING IDEAS for this page. Include a short description and, if possible, a photo or sketch.

We'll pay a small honorarium for each one that's accepted.

Write to:

Operating Ideas,
Engineering & Mining Journal
330 West 42nd Street
New York 36, N.Y.

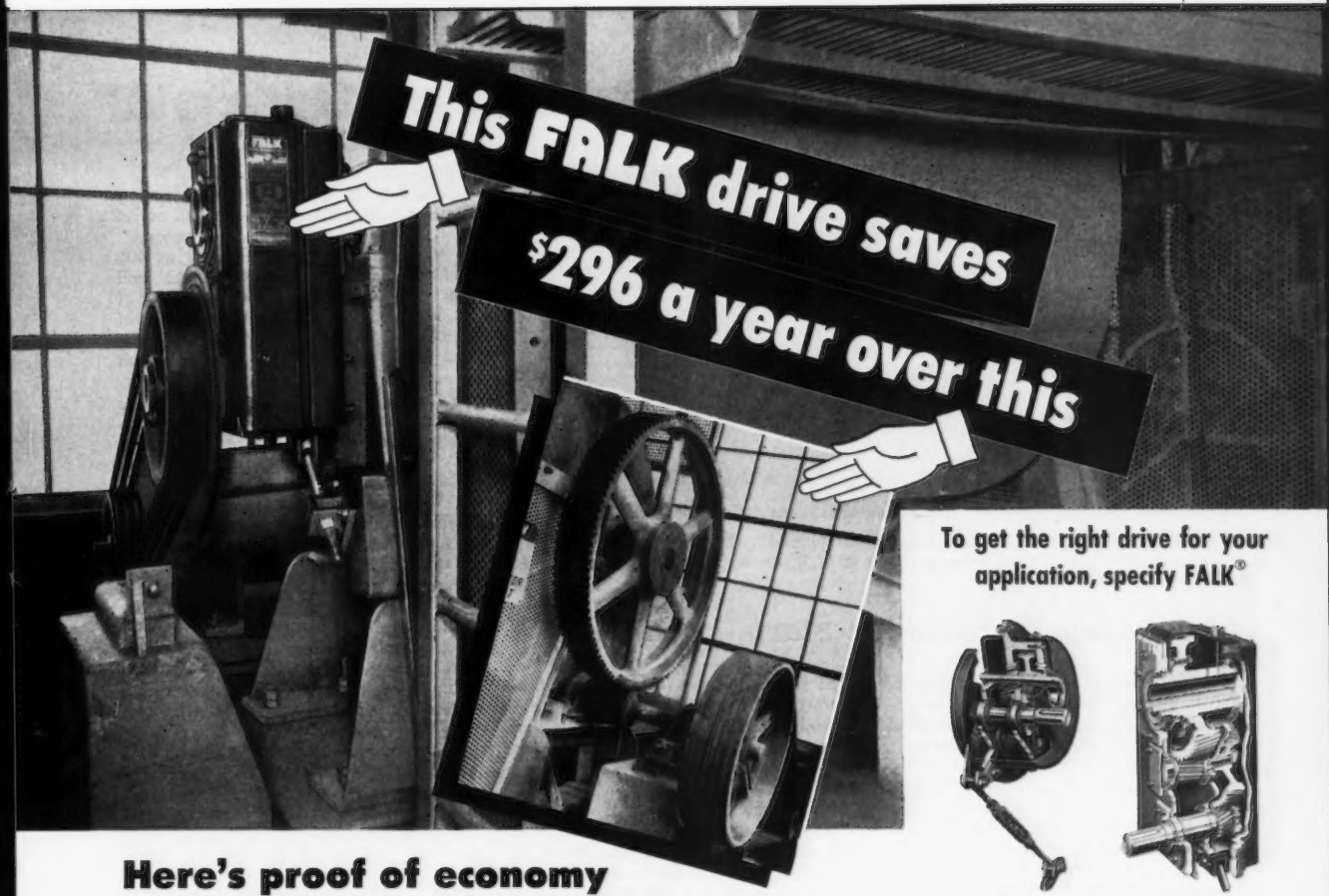
Steel and Rubber Sandwich Eases Strain on Crusher Casting

A SLAB OF SHEET RUBBER, sandwiched between two mild steel plates, reduced jaw crusher damage at Blue Rock Quarries, Gosnells, Western Australia.

Blue Rock's unit crushes diorite and granite and, because of the elongation of the jaws, excessive strain was being placed on the castings holding the jaws.

The jaws fit into a lug on the bottom of the main casting and are firmly wedged in on the top. A thick copper shim is placed under the wedges to act as a buffer. In spite of these precautions, the manganese steel jaws stretched and the copper shim thinned and hardened, and the castings cracked or broke off.

The steel plate and rubber sandwich was placed between the wedgeblock and the jaw and the wedges were forced in to hold the jaw in place. It held the jaw firm and lessened the pressure on the wing stock. As the jaw lengthened, the rubber compressed and no strain was put on the bottom lug.



Here's proof of economy with FALK Shaft Mounted Drives

PROBLEM—For many years, a prominent Eastern abrasives manufacturer* experienced high maintenance and down-time costs, as well as excessive noise and vibration, in the operation of 19 pebble mills driven by open spur gears. Drive gears and jack shaft pillow blocks required frequent repairs or replacement, and trunnion shafts often failed, due to radial overloading of the bull gear when broken pinion teeth bottomed between gear teeth.

SOLUTION—After numerous unsuccessful approaches to these problems, the solution was found by mounting a Size 315J FALK Shaft Mounted Drive directly on the mill drive trunnion. This eliminated objectionable gear noise and vibration...greatly reduced costly down-time and loss of production...and cut annual maintenance and replacement expenses as indicated by the following figures taken from the customer's records:

Spur Gear-and-Pinion Drive		FALK Shaft Mounted Drive	
Bull Gears	$ 56	VEE Belts	$ 30
Pinions	120	FALK Shaft Mounted Drive (based on 10-year life)	70
Pillow Blocks	90		
VEE Belts	30		
Trunnion (5-year life)	100		
Annual cost	$396	Annual cost	$100
		ANNUAL SAVINGS	$296

IF OBSOLETE DRIVES ARE COSTING YOU MONEY, a change to Falk All-Steel Shaft Mounted Drives can effect important savings in money and production. Used on almost any type of machine, these compact, rugged units are establishing new standards of economy and efficiency in many industries. Specify FALK Drives on your purchased equipment...For full details, **write for Bulletin 7100.**

*Name on request

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Horizontal or vertical units—½ to 50 hp—420 to 5 rpm—single and two double reduction ratios—output torque ratings up to 41,000 lb-in (consult factory for higher torque capacity).

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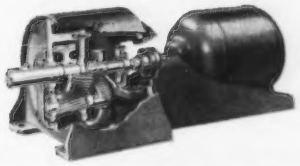

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• • •

FALK Drives are available from factory and distributor stocks from coast to coast. Consult your Falk Representative or Distributor.

FALK

...a good name in industry

WORK nears completion on ore concentrator plant at Anaconda Co.'s El Salvador copper mine in Chile. The mine is 7,800 ft high, on western slope of the Andes.

Anaconda's El Salvador Starts Production

ANACONDA CO.'s new $110-million El Salvador copper mine (*E&MJ*, November 1958, p 93) on the western slope of the Chilean Andes went on stream in late April. Early production of 3,500 tons per month will increase to 100,000 tpy by July 1 as construction on the huge crusher and concentrating plant at the mine portal is completed.

The mine is expected by Anaconda to be one of the world's lowest-cost copper producers with proved copper sulphide reserves of at least 375-million tons averaging 1.5% copper before exploratory drilling was suspended last year. This is estimated to be enough ore for 40 to 50 years operations at 100,000 tpy.

El Salvador will replace Anaconda's Potrerillos mine, 18 miles south, whose orebody is almost depleted. Potrerillos, after producing an estimated 1,850,000 tons of copper in the last 73 years will close June 1 and the men will be transferred to the El Salvador project.

Ore concentrate in slurry from El Salvador will be transported by a 17-mile pipeline to Llanta, on the company-owned railroad line. There the concentrates will be filtered at a new plant, and shipped by rail to the Potrerillos smelter. Blister copper from the smelter will be hauled to the port of Barquito, about 125 miles to the west, and shipped to Perth Amboy, N. J. for final refining.

NEWEST yellow cake producer in the Ambrosia Lake district of New Mexico is the Kermac plant, dedicated in mid-April. Layout is by Stearns-Roger Mfg. Co

Kermac Nuclear Dedicates a 3600-tpd Mill

OFFICIAL DEDICATION of the new Kermac Nuclear Fuels Corp. mill at Ambrosia Lake, N.M., took place in mid-April. The 3,630-tpd plant went into production Nov. 28, taking ore from Kerr-McGee properties in the area, and some of the output of other independent mines in Ambrosia Lake.

Speakers at the dedication included Sen. Robert S. Kerr of Oklahoma, chairman of the board; Dean A. McGee, Kermac Nuclear president; and George H. Cobb, executive vice president.

The $18-million plant, built by Stearns-Roger Mfg. Co., operates on an acid leach, solvent extraction process.

A sulphuric acid plant, rated at 400 tpd, produces process acid at the mill site and represents an investment of $1.5-million. Molten sulphur from West Texas is used to produce the acid in one of the most modern mills of its kind in existence. The entire plant is operated by an operator and one helper. One large electrical control panel records temperatures and concentrations at various points in the process, with an alarm system provided as a watchdog.

Highlights of the uranium mill flowsheet include:

A receiving pit made up of sixteen 1,000-ton ore pockets to accommodate the ore. With all pockets filled, the pit can supply feed for four days run at rated capacity;

A sample tower which cuts its samples from the throughput until a 200-lb sample of each 1,000-ton "batch" is taken. The sample is reduced to a 6-oz unit for laboratory testing;

Fine ore bins which blend the lots for consistent grade of feed to the mill;

Counter-current decantation which provides a solution of 90 to 97% recoverable uranium.

AEC Okays 522-tpd Mill For Federal-Gas Hills

FEDERAL URANIUM CORP., Salt Lake City, and associates have won approval for 522-tpd uranium mill in Gas Hills District of Wyoming.

One of two new concentrators to be built in the area under the "limited expansion" of milling to provide market for ores discovered up to Nov. 1, 1957, contract for concentrates was signed between AEC and the "Federal-Radorock-Gas Hills Partners."

Federal will be general manager of the venture in which its affiliate, Radorock Resources, Inc., Salt Lake City, and Gas Hills Uranium Co., headed by Cotter Ferguson, Laramie, Wyo. are associated.

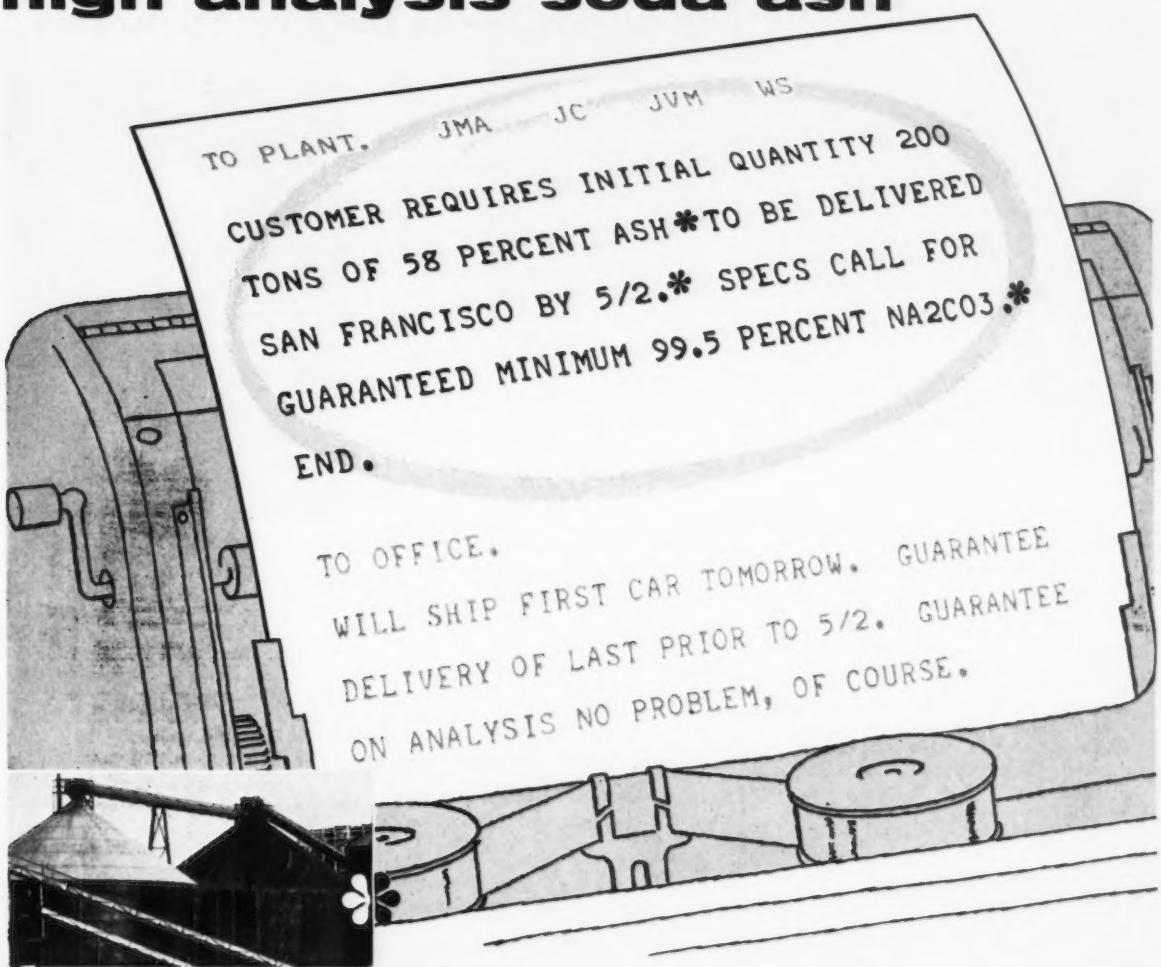
Nels Stalheim, chairman and chief executive officer of Federal, announced that the mill would cost $3-million and that an additional $3-million would be spent on mine development.

The partners claim 1-million tons of ore proved and 1.5-million blocked out.

Ralph W. Neyman, Salt Lake City, Federal president, will direct all operations and manage the project. Western Knapp Engineering Co., San Francisco, has design and prime contract on the concentrator. An "Infilco, acid-leach, resin-in-pulp" process will be employed. Construction is already underway on the mill 52 miles from Riverton, Wyo., and completion is scheduled by December.

AEC said that "the Federal-Radorock-Gas Hills Partners contract, which runs through Dec. 31, 1966, provides a firm market for a number of independ-

West End "fills the order" for high analysis soda ash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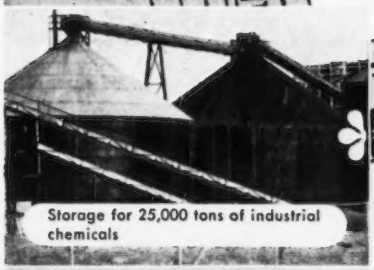
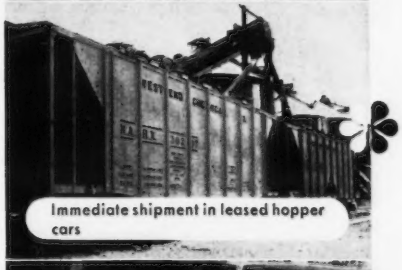
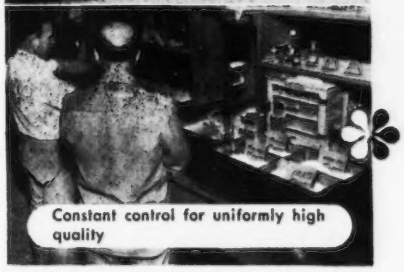

Storage for 25,000 tons of industrial chemicals


Immediate shipment in leased hopper cars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ent producers whose properties hereafter are 'dedicated' to the new mill."

"The Commission believes that the inclusion in the contract of firm allocations to these ore producers will make it possible for the mines to operate at a rate consistent with good mining practice for the economical extraction of ores," said the AEC's Grand Junction Operations Office.

The contract brings to 24 the number of uranium mills which will be operating in western United States. Still pending before AEC are expansion contracts for two existing Gas Hills area mills and one new mill (Union Carbide Nuclear).

The Federal-Radorock-Gas Hills Partners venture represents a successful effort by an "independent" in securing a concentrates contract in the district.

Partners were engaged in a deadline race to prove up ore reserves. During this period, Federal, et al. drilled more than 300,000 ft of hole in reserve determination.

Los Alamos Wins Power Direct From the Atom

DIRECT CONVERSION of nuclear fission into electricity—long a goal—has been achieved at Los Alamos testing center without the use of steam generators, turbine and power generators. If proven in large-scale models, the new discovery would obviate everything in a power station other than the reactor itself.

Estimates are that a direct reaction would reduce nuclear reactor construction cost by about 50%. Still, the discovery is a long way from a breakthrough into a new nuclear technology. The discovery was a happy accident, power being obtained while looking for something else. A small uranium rod, ¾-in. long and ½-in. dia, was lowered into the reactor core and heated until the chamber was filled with cesium vapor to form a thermocouple.

At this point, the uranium metal began to fission, throwing off charged particles which flowed through the cesium cloud toward the cooler outer edge of the reactor, producing a flow of electrons (about 5 watts of electricity) sufficient to keep an electric bulb lighted for about 12 hours. A larger model is now under construction that, it is hoped, will yield about 5 kw of electricity (enough to handle the needs of the average home). Los Alamos scientists hope that this experiment will pave the way to a commercial power plant or, at least, a rocket motor design.

Beryllium Is Forged

A 50,000-TON pressure forging technique, designed by Wyman-Gordon Co., has produced large structural beryllium shapes that required a minimum of machining, and that are as ductile as strong aluminum alloys. High purity beryllium powder is used in the press, which rapidly produces the forgings.

Man in the news.

Oscar Straus—An Old Firm Starts Anew

FORMATION of an exploration department of the firm of Guggenheim Brothers was made known last month with the announcement that Oscar S. Straus, a director of American Smelting & Refining Co. has become a partner of the firm.

Mr. Straus, who remains an Asarco director, resigned his post as chairman of that firm's finance committee on taking his new post May 1.

The appointment of Mr. Straus by Guggenheim Brothers marks a re-entry of the famed organization into active participation in the mining industry, where in earlier times it achieved success in the development of the Chile copper process for making electrolytic copper direct from copper solutions in plants adjacent to the minesite; development of Chile Copper Co.; the Guggenheim process for nitrate reduction; and the development of the Utah, Nevada Consolidated, Chino, and Ray porphyry mines.

The first of the predecessor firms to Guggenheim Brothers was founded by Mr. Straus' grandfather, Meyer Guggenheim, who came to this country from Switzerland with his father in 1847. His original operation was a small smelter in Pueblo, Colo. Both Kennecott Copper and Asarco trace their history to the early operations of the Guggenheims.

The re-emergence of the partnership as a mining firm, with plans to develop, find, and operate mineral-producing facilities is based on what Mr. Straus calls "the widest possible range of interest.

"We are building up an exploration staff," he said, 'but we are building slowly. We have no desire for a huge headquarters staff which might later restrict expansion. We are going to let what we find, and where we find it, dictate our growth for a while."

Beginning at the beginning, Straus was, at the time of this interview, preparing to leave for a tour of likely Latin American sites. Operations will be confined at first to the Western Hemisphere, he noted, with early emphasis on Latin America.

How do you go about 'starting cold' on an exploration program?

"First, you go and talk to the people involved," he said. "In my trip to Latin America, I'll talk to mining people first, and simply ask where the activity is. We are eager to work with local nationals, to our mutual benefit. These days, you can't do it any other way, and we don't want to do it any other way."

Any preferences as to kind of mineral?

"First, talk to the people . . ."

"Naturally, when you start out with an operation like this, you cannot be restrictive. We are very interested in the 'newer' metals; columbium, beryllium, bismuth and the like. But certainly, if we found another Chuquicamata, we wouldn't run away from it. We feel that we have sufficient resources to take on whatever obligations a given discovery might demand."

Foreign investment isn't always welcome in some nations. Will you deliberately avoid investigating certain countries?

"Not at all. While the climate of some countries is more attractive than others, we are sure that successful negotiations are possible in all of them. It's simply a matter of negotiating and acting in good faith."

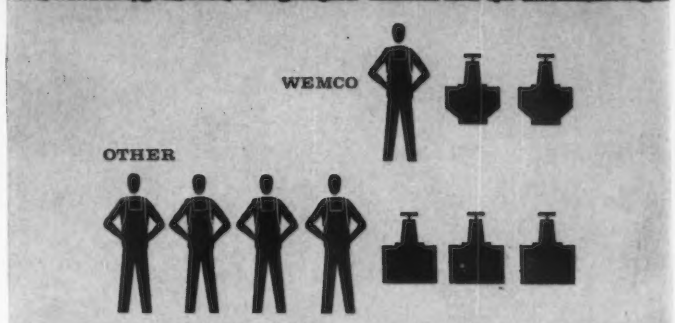
Then, after 20-odd years, the firm is returning to active mine operation?

"Yes, and with the benefit of modern methods and modern means of transportation to help do it better."

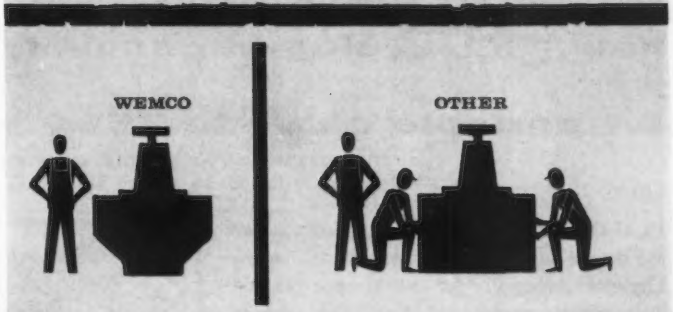
Mr. Straus, after his Latin American tour, is planning another trip to Europe, with stops in Spain and Turkey. "I've always enjoyed visiting mining properties. All the while I was growing up, I visited mining camps with my father (the late Roger Straus of Asarco). My 17-year-old son now visits them on his occasional trips with me."

Mr. Straus, before joining Asarco, was associated with the First National Bank of Kansas City, and during the war was with the U.S. Foreign Service and served with the U.S. Coast Guard as a Lieutenant, j.g.

LABOR REQUIREMENTS REDUCED, MAINTENANCE COSTS CUT... WITH WEMCO-FAGERGREN FLOTATION



Fewer machines and fewer personnel



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Wemco-Fagergren equipment costs less, *much* less, to operate! Operating labor is reduced because Fags need little or no adjustment to compensate for feed variations. Simplicity of design and operation assures fewer maintenance problems—and less cost. There is less wear and replacement of parts, less downtime because wear-exposed parts are rubber covered and an entire mechanism is easily removed for inspection and repair without shutdown of pulp flow.

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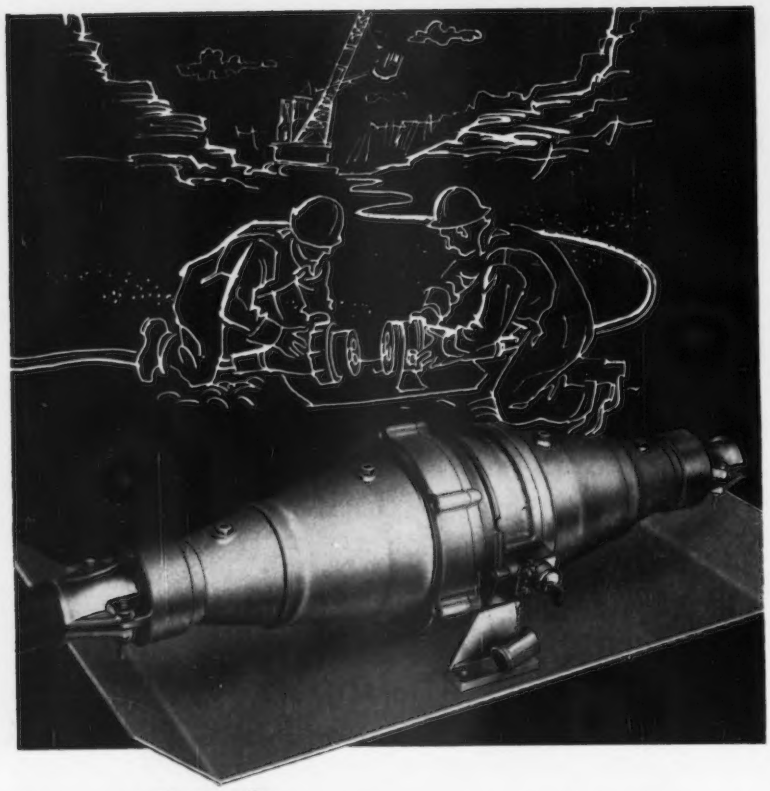

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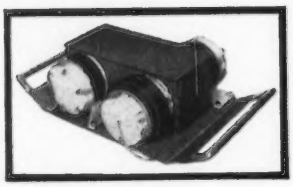
Coupler consists of plug and socket, with contacts mounted in single-piece, pressure-molded insulators and housed in heavy cast aluminum housings. Safety features protect personnel and equipment. Optional mechanical and electrical features meet complete range of requirements. Rating, 300 amperes, 7500 volts, grounded neutral. Write today for descriptive bulletin 375. PLM Products, Inc., 8183 West 150th St., Cleveland 11, Ohio.



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CABLE PLM COUPLERS

IN THE U.S.

ALASKA

Little Squaw Mining Co. is being formed to drive several hundred feet of tunnel on the Little Squaw Vein in the Chandalar. Work on other veins is also being contemplated by Eskil Anderson, company manager. Drilling and mucking equipment will be flown to Chandalar Lake together with equipment and supplies for Ed Toussaint's operation on other veins in the district and Hugh Matheson's placer operation on Big Creek.

The fourth annual meeting of Alaska and Yukon Territory mining and petroleum engineers was held April 2-5 in Anchorage under the joint sponsorship of the Alaska and Southwest Alaska sections of AIME and the Yukon section of the Canadian Institute of Mining and Metallurgy.

Independent oilman Michel T. Halbouty of Houston, Texas, whose company is now drilling a well near the Swanson River Unit on the Kenai Peninsula, was principal speaker at the conference.

Other speakers were Dr. E. N. Patty, president of the University of Alaska, and Erik Neilsen, member of the Canadian Parliament from Yukon Territory.

More than 20 lecture papers were presented by prominent men in the mining and metallurgical industries, including the following:

Kirk Stanley, geologist, Strandberg Mines, Inc., "Geology of Iron Creek area in Talkeetna Mountains."

C. D. N. Taylor, assistant manager of United Keno Hill Mines of Canada, "Management Problems in Mining at United Keno Hill Mines, Yukon Territory, Canada."

Richard S. Ludwig, mechanical superintendent of United States Smelting, Refining and Mining Co., "Sled Transportation of Heavy Single Loads in Interior Alaska."

Andre Beguin, of Cassiar Asbestos Corp., Ltd., "Milling Procedure at Cassiar Asbestos Property in British Columbia."

Robert W. Vinnedge, mining engineer with Goodnews Bay Mining Co., "Goodnews Placer Platinum Deposits."

John C. Hoffman, Alaska operations supervisor with United Geophysical Co., "Geophysical Exploration in Alaska."

William E. Whitney, development engineer with Standard Oil Co. of California, "Drilling Principles and Equipment."

Joe Fehrenbach, Alaska district superintendent with Halliburton Pilwell Cementing Co., "Drillstem Testing Techniques."

The following papers were also delivered:

Reuben Kachadorian and C. L. Sainsbury, geologists with Alaska branch, U.S. Geological Survey, "Geologic Factors Affecting Proposed Nuclear Harbor in Northwest Alaska."

Peter O. Sandvik, research associate in mining at University of Alaska, "Re-

Okocord Red Saddle twin Type W cable in action on loader and shuttle car at Intermountain Chemical Company's trona mine. Secret of Red Saddle's added strength and security against short circuits is the pre-formed, red neoprene protective wall between the conductors, and the compact construction in which all components are locked together for maximum ruggedness.

They've cut mining costs with tougher cables

"We've found that the longer life of Okocord cables means lower operating costs for us," says Jack Wilson, Maintenance Supervisor for Intermountain Chemical Company of Westvaco, Wyoming. "Our mining operation is almost 100% electrified. We need cables that can stand up to extreme abuse. Okocord mining cables have everything it takes to prevent work stoppages that waste man hours or immobilize expensive equipment." They're tough, highly flexible, and unaffected by oils, acids, alkalies or mine water.

On its shuttle cars—key to continuous, efficient operation—Intermountain finds that Okocord Red Saddle twin cable stands up best to high-speed reeling and unreeling . . . to being stretched tight against sharp tunnel wall corners . . . to frequent cable runovers . . . and to pulling and stretching. Says Mr. Wilson: "Okocord Red Saddle shuttle car cable minimizes internal shorts due to cable abuse."

There are Okocord quality cables to keep *your* mining equipment operating efficiently: shovels, drills, cutting equipment and other machinery. There are Okonite specialists ready and willing to help you in planning new cable systems. And there is an illustrated, 76-page booklet on mining cables that's free when you write for Bulletin EM-450, The Okonite Company, Passaic, New Jersey.

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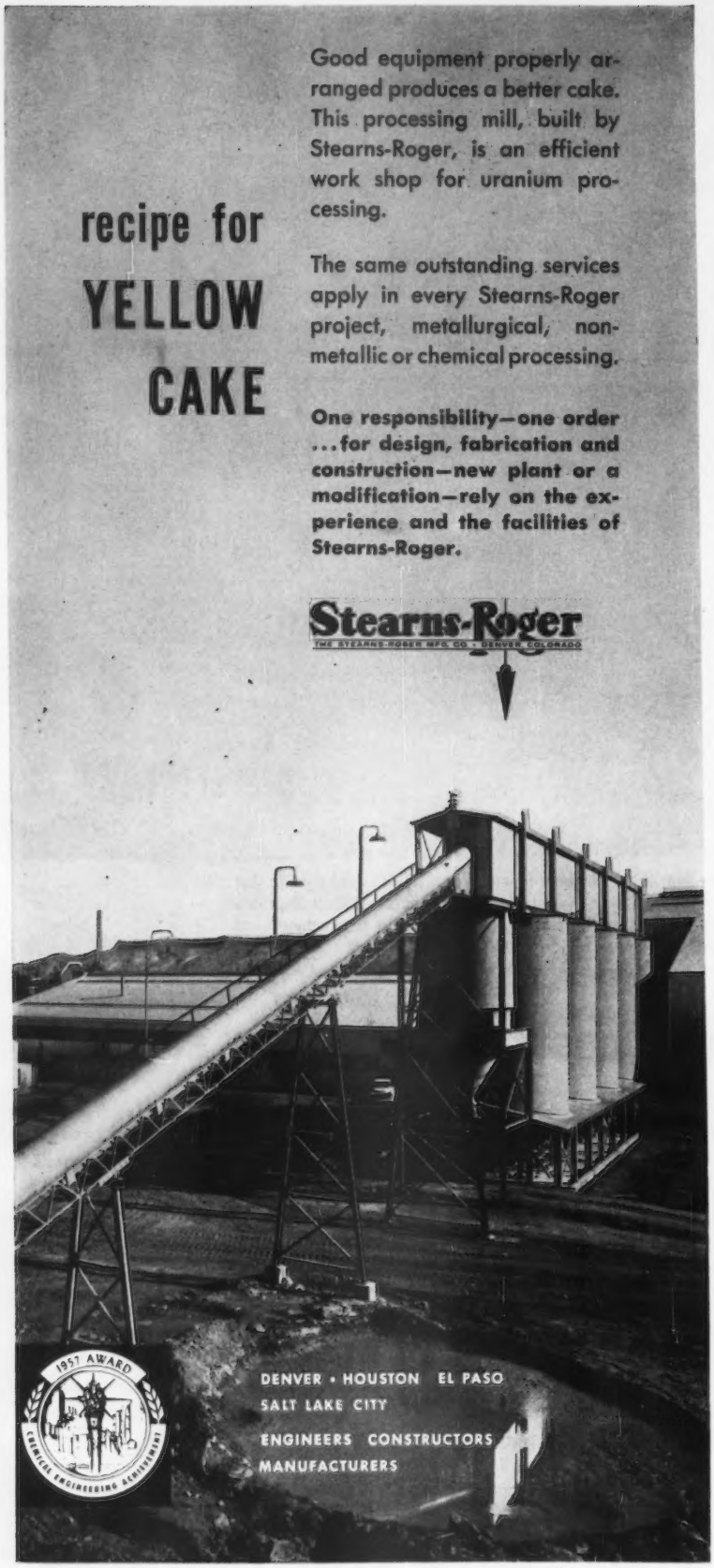
5218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Alaska *(Continued)*

gional Structural Control of Mineralization in Alaska."

Phil R. Holdsworth, Alaska commissioner of mines, "State Selection of Land and Its Effect."

Dr. Troy L. Pewe, head of geological department at University of Alaska, "Permafrost and Its Effect on Life in the North."

Harry B. Keller, Lawrence Radiation Laboratories, University of California, "Application of Nuclear Explosives to the Mining Industry."

ARIZONA

Banner Mining Co. will sink a 5-compartment, 1,000-ft shaft to increase production from new reserves at its Daisy Mine in Arizona's Pima District.

The shaft will be about one mile from the present two-compartment shaft, now below 690 ft.

Banner has never detailed ore grade or reserves, which in the last three years have been developed as a result of both surface and subsurface drilling. Even the stockholders report has not covered this in the past.

E. S. Bowman, Tucson, presented the annual report at the recent stockholders' meeting in Salt Lake City. He said "core drilling on our state-leased lands in the vicinity of the Daisy Mine was continued unabated with very encouraging results during 1958."

Only the Daisy Mine was operated at full capacity during the period of low copper prices in 1958. Mineral Hill Mine in the Arizona district was worked on a reduced basis. The Glance Mine at Twin Buttes was shut down. The firm's Bonney and Miser's Chest mines in the Lordsburg, N.M. copper district were shut down, but development work was carried out and some development ore was shipped.

Both the Bonney and Miser's Chest mines will be reopened if copper prices continue to improve in 1959, it was stated.

"Considerable amounts of low-grade oxidized copper ores, which are unmarketable unless beneficiated, have been found in the Mineral Hill-Daisy Mine area," Bowman said. He added that above the sulphide zone in the properties the oxide ores are not adaptable to ordinary acid-leach process. Work is continuing on perfecting a process for treatment of the ores.

San Manuel Copper Corp., San Manuel, and Magma Copper Co., Superior, returned March 1, to a 6-day production work week. The announcement for Magma Copper was made by Darrell Gardner, general manager. Magma went on a 5-day week when production was reduced more than a year ago. Gardner said the same production schedule that was in effect before the cutback will again be maintained. San Manuel Copper Corp. is a subsidiary of Magma.

Work is progressing rapidly on an expansion program including 12,800 ton

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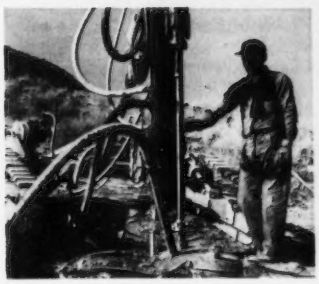
THE BLAST:

Utah Lime and Stone Company near Grantsville, got excellent fragmentation from this blast with low-cost USS Ammonium Nitrate. The dense stone in the carboniferous quarry has a hardness of 3.29 Mohs.

THE MATERIAL:

Three quarts of fuel oil were added to every 50-pound bag of prilled USS Ammonium Nitrate and allowed to stand for at least one week so the oil would thoroughly permeate the prills. A 2 x 8-inch stick of 75% dynamite, initiated with an electric cap was used to detonate each hole.



a.

b.

c.

d.

HOW IT WAS DONE:

a. Nineteen vertical holes were drilled, 3½ inches in diameter with an average spacing of 10 x 10 feet. The deepest hole was 64 feet and the shallowest, 48.

b. Three horizontal holes, 3½ inches in diameter were drilled to an average depth of 44 feet.

c. A total of 100 to 125 pounds of USS Ammonium Nitrate-fuel-oil mixture was put into each hole: one-third of a sack was poured or blown in first, then the primed detonator, then the remaining mixture. The charge was stemmed to the surface with limestone cuttings from the drilling operation.

d. A pneumatic loader was used for rapid filling of horizontal holes.

For further information on using safe, low-cost USS Ammonium Nitrate in your blasting operations, write to United States Steel, Coal Chemical Sales, 919 Kearns Building, Salt Lake City, Utah. *USS is a registered trademark*

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Arizona *(Continued)*

capacity fine ore storage bins, a 6,000 ton track hopper, and a secondary crusher, at Ray Mines, Div. of Kennecott Copper Corp. Ore no larger than 10 in. will be shipped from the primary crusher at Ray in new 100-ton ore cars to the track hopper, eliminating existing trestles. Ore will be transported from the hopper by three 48-in. conveyor belts to the secondary crusher for additional crushing and then by 1900 ft of 48-in. belt to the fine ore storage bins.

CALIFORNIA

An H-iron pilot plant is being built by Bethlehem Pacific Coast Steel Corp. on property adjacent to that company's Vernon steelmaking facility at Los Angeles. Designed for an average daily production of 110 tons of crude metallic iron, the plant will test results with ore from various sources and of different iron content.

H-iron is produced by direct reduction of ore using hydrogen instead of carbon as the reducing agent. The process is carried out at relatively low temperature and high pressure. The required hydrogen is produced as an integral part of the operation by partial oxidation of natural gas. Bethlehem will process the resultant crude metallic iron into steel at the adjacent plant.

Initial research on H-iron production has been carried out for years by Bethlehem at its Trenton, N.J. pilot plant in collaboration with Hydrocarbon Research Corp. The new plant will explore economic aspects of using low-grade ore in the process.

Kern Uranium Co. plans for its Little Sparkler mine in Kern River Canyon call for producing the second level at 160 ft from an existing winze; sinking the main shaft to the third level; increasing mechanization of the actual mining operation; improving of ore handling at the surface, and, possibly, increasing mechanization of upgrading processes at the mine head, according to Lloyd Scouler, president. Ore reserves were recently calculated by the company at minimum of 49,000 tons at .50% U_3O_8.

COLORADO

DuPont Co. exercised its option on mining claims and mineral rights to a large section of land near Powderhorn as a future reserve of columbium ore, it was announced.

The long tangled legal status of some sixty mining claims in the Powderhorn vicinity was unraveled when the E. I. DuPont de Nemours & Co. of Wilmington, Del. paid $20,000 to a Gunnison Syndicate to exercise its option, according to records in the Gunnison County abstractor's office.

DuPont will purchase patented and unpatented mining claims of the Gunnison Syndicate and has obtained all

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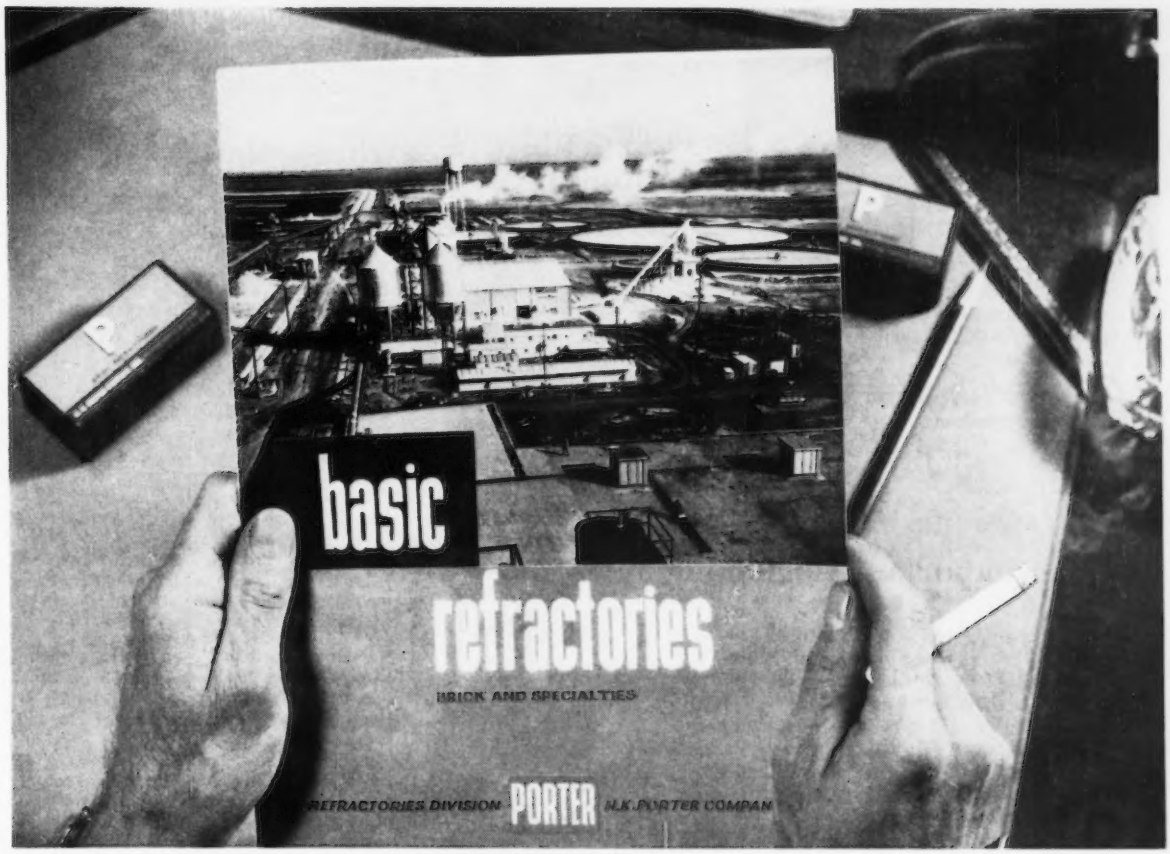

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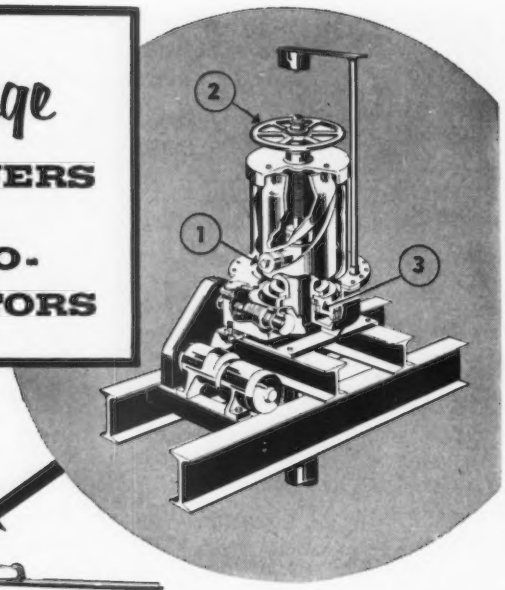

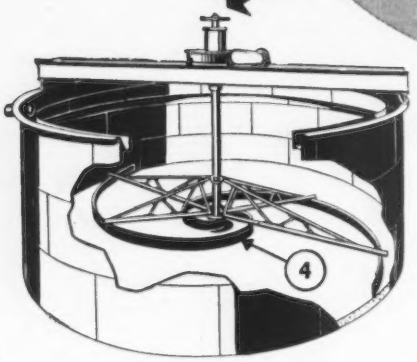

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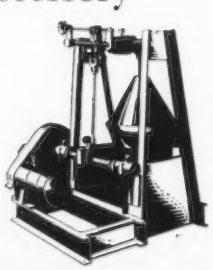
Hardinge Diaphragm Pumps handle metallurgical and chemical pulps, particularly pulps from thickeners. The operator may adjust the stroke or capacity while the pumps are in operation — a very important feature. Moving parts are well above the bowl and out of any splash zone. Valves may be changed without dismantling the unit.



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Colorado *(Continued)*

rights in the property held by the Humphreys Gold Corp. It also will buy several other adjacent properties on which it holds options.

The Powderhorn mining claims make up a natural adjunct to DuPont's development work in the field of columbium metal, according to F. H. Weismuller.

The Deadwood mine at Cripple Creek, with shipments of about 1,000 tons of ore monthly, continues as one of the most productive mines in the district. Lloyd Stoner, in partnership on the Deadwood with Jerry Muzik, said that the ore has been running from .20-1.78 oz gold to the ton with an average of .50 oz.

USBM Estimates Oil Cost For Nuclear Shale Tests

Cost of producing shale oil by nuclear explosions and in situ combustion is conservatively estimated at $2 to $3 per barrel (including 12% profit on the total $5- to $6-million capital investment, after taxes, amortization, etc.), according to Carl C. Anderson, chief petroleum engineer of the U. S. Bureau of Mines. However, in his talk to the North Texas Oil & Gas Association at Wichita Falls on March 21, Mr. Anderson said better technological data is needed for an accurate estimate. The needed test would cost $2.6-million. The studies were made for the Green River oil shales in the Piceance River Basin of northwestern Colorado.

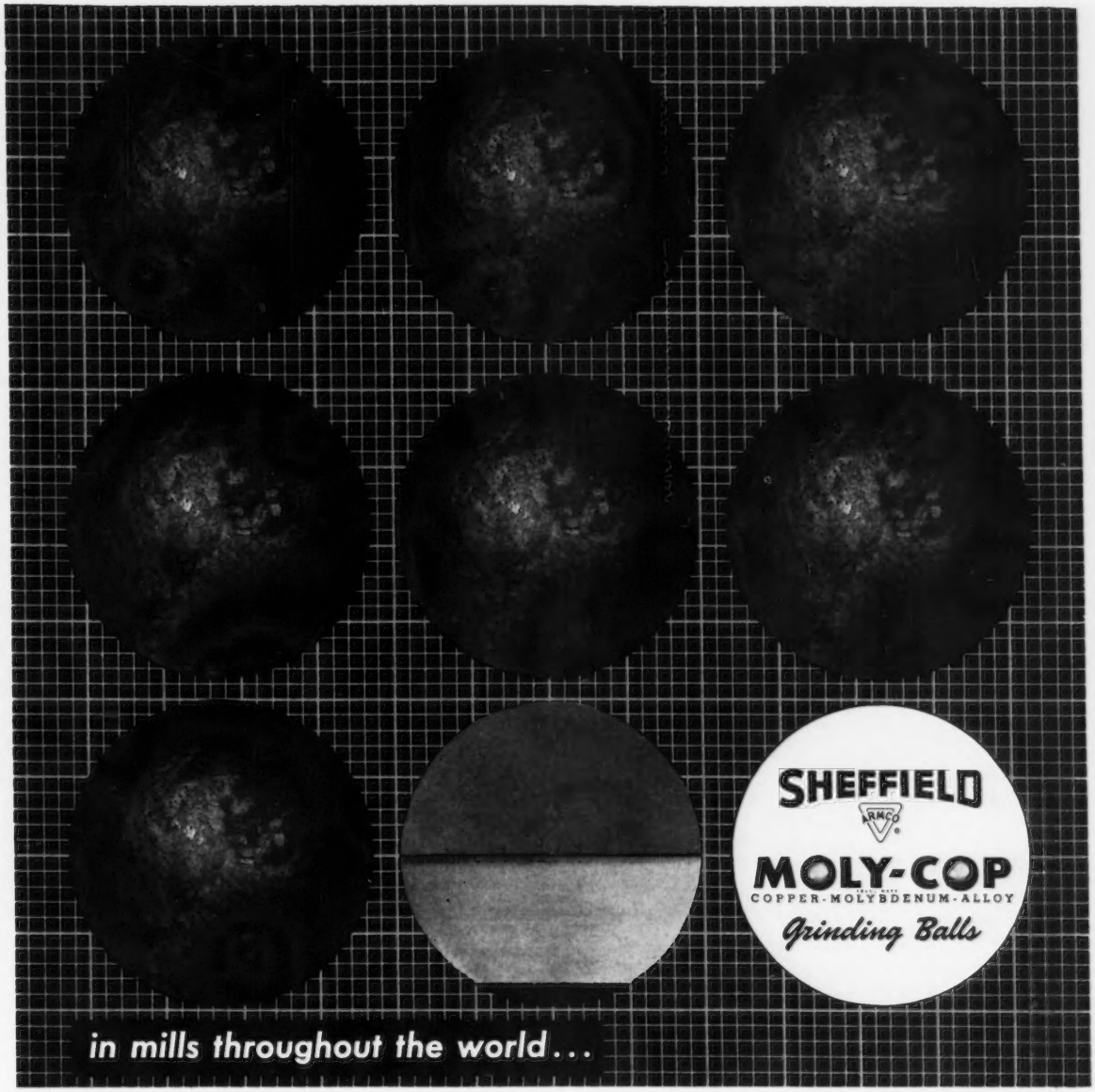
Merrill E. Shoup, president of the Golden Cycle Corp., announces that the corporation has made arrangements and put into motion a development and exploration program to spend an additional $5,000 per month in the Cripple Creek mining district over and above the present mining expenditures, to locate and develop new bodies of ore.

"We have continued to carry on in the Cripple Creek mining district since the ill-fated Order L-208 was entered by the War Production Board on Oct. 8, 1942, with the sincere belief that the time will come when something will be done about the price of gold."

Review of uranium concentrates procurement during last half of 1958 discloses American Atomic Energy Commission has effected further reductions in the price it is paying for U_3O_8.

The statistics released by AEC's Grand Junction Operations Office shows average per pound price paid for $124-million worth of concentrates came to $9.33. The average price paid during fiscal 1957-58 for domestic concentrates was $9.66. In fiscal 1956-57, the price was $10.64 a lb.

AEC said that despite process of 3-million tons of uranium ore from domestic sources during last half of 1958, reserves on Jan. 1 stood at 82.5-million tons in U.S. This is compared with slightly more than 70-million tons at start of last year.



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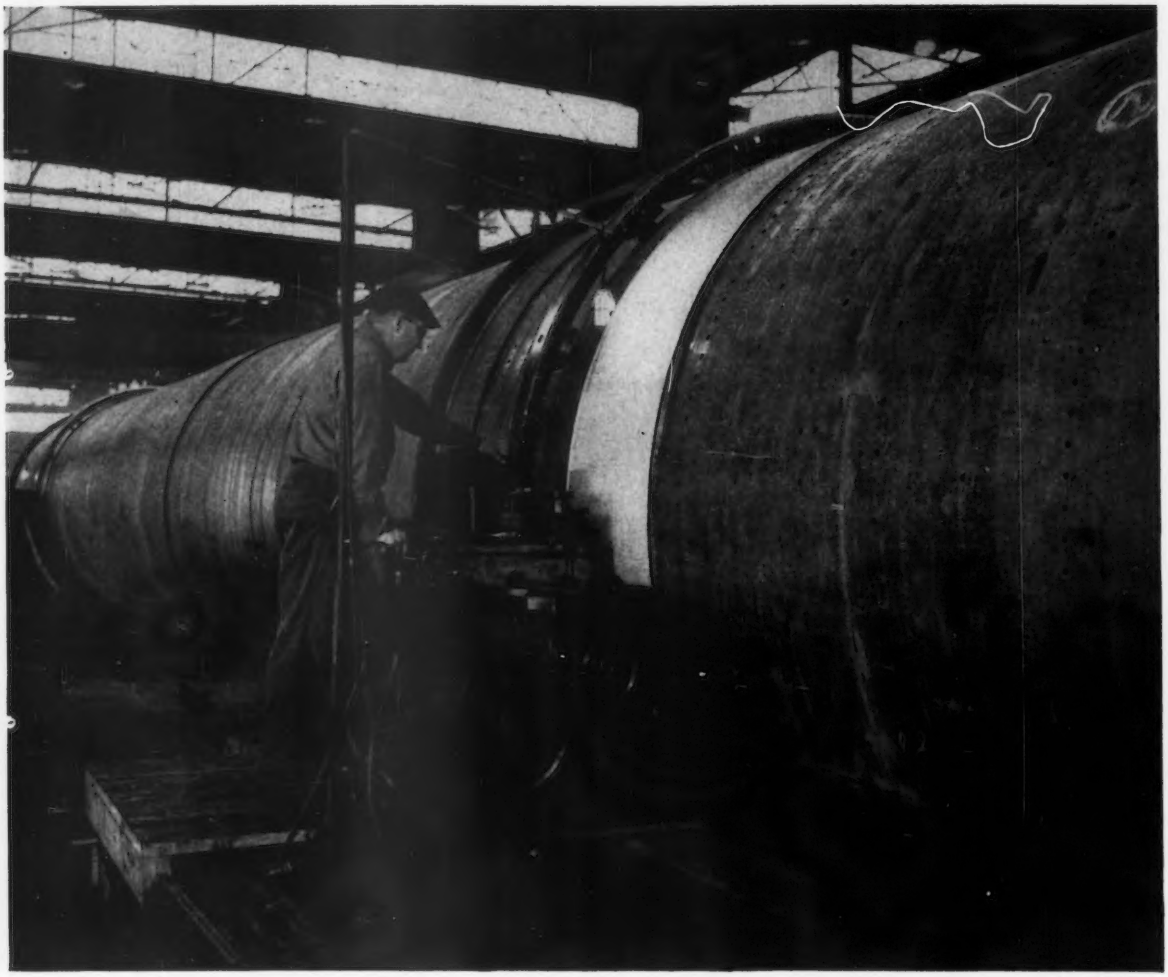

Louisville Dryer—10 feet in diameter, 10 stories long!

Turn a ten story building on its side, and there'd be room to spare on either end of this huge pit lathe at Sharon, Pennsylvania where this 10′ x 110′ Louisville Dryer was fabricated.

This lathe is used for machining the reinforcing bands onto which are mounted the forged steel tires. This careful workmanship assures concentricity of the completed dryer shell—a primary factor in efficient seal operation.

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GEORGIA

Aston Mineral Engineering Co. of Chattanooga, Tenn., and Tate, Ga., is operating a sericite property at Waleska for the Georgia Talc Co. Aston Mineral Engineering did the preliminary exploration work and is presently sinking a slope. The sericite is being trucked to the plant at Chatsworth for milling.

R. Lee Aston, consulting mining engineer and geologist of Aston Mineral Engineering Co., has been appointed southeastern representative for the Anton Smit & Co., manufacturer of diamond drill bits and tools.

IDAHO

An extensive high-grade limestone deposit — estimated to contain up to 1-billion tons—has been located in the mountains along the Snake river south of Lewiston, Idaho, according to information presented at an Army Engineers hearing on Columbia river basin development held at Lewiston March 10.

The limestone, which is of suitable grade for cement, agricultural fertilizer and other industrial uses, is located at two points in the Snake river valley. One is at Lime Point, right along the river, and the other is at Halfway, Ore.

A paper presented at the engineers hearing by Robert D. Thompson, a former Halfway resident and one of the owners of the limestone property near Halfway, described the property as covering more than 180 acres and extending to a depth of 2500 ft. He considers the area suitable for open pit mining.

John Edgar, general manager of the Sunshine Mining Co. near Wallace, told stockholders in the company's annual report "the most significant ore development in recent years has been taking place along a newly discovered vein in the footwall of the Chester fault in the eastern portion of the mine." He said development ore is averaging 28.4 oz silver and 2.6% lead to the ton. Edgar said also that the Sunshine's participation in a geological reconnaissance of southeastern Alaska has resulted in discovery of a "promising" copper occurrence. Robert M. Hardy Jr., president, told stockholders the year 1958 was one of "steady progress" for the company.

The lead-zinc climate is unfavorable and may well remain so for a year or more until there is a sound basis for mining 350,000 tons of lead and 550,000 tons of zinc annually in the U.S., Henry L. Day, president and manager of Day Mines Inc., stated at Wallace. He said Day Mines is working with other domestic producers to achieve this result. Day told stockholders of the company that 1958 development at the Dayrock mine had failed to find the downward extension of the Bonanza orebody in that property and he said mining and milling at Dayrock has been held down to about one fourth of capacity awaiting better metal prices. Day also said that operations of Day Mines in 1958 were

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Idaho *(Continued)*

made successful by steady production of gold-silver ores from the company's Gold Dollar property in Ferry County, Wash., and by silver-copper ores from its 25% interest in a lease the American Smelting and Refining Co. holds on the Galena property near Wallace.

Idaho Mining and Milling Inc., with headquarters at Lewiston, has purchased a bucket line gold dredge from Rare Earths Inc., of McCall, Idaho, and has installed the equipment to dredge grounds in the Florence Basin of Idaho, where the company is operating on Meadow Creek.

John D. Bradley, president of the Bunker Hill Co. reports the company is making definite and constructive steps to diversify its operations and broaden its product base and said that when these objectives are realized the company will be in a stronger competitive position within the lead-zinc industry and at the same time able to enjoy greater earning stability. The company's capital expenditures totaled $791,144 in 1958, Bradley said, with the largest amount spent for replacement and modernization of the company's lead smelter and zinc plant at Kellogg, Idaho.

What is characterized as an "important new discovery" of silver-lead ore has been made in what is known as the Veral vein of the Bunker Hill mine at Kellogg. The new ore lies in a block of ground hitherto totally unexplored between the mine's No. 9 and 27 levels, well within the boundaries of the Bunker Hill ground, company officials say.

May 1 has been set by L. J. Randall, president of the Lucky Friday Silver-Lead Mines Co. as the target date for start of work on the new $400,000 milling plant at the Lucky Friday property near Mullan. The mine is operating five days per week and ore reserves have been estimated at 799,627 tons. Randall reported principal development at the Lucky Friday is on the 2600-ft level where ore has been opened for a length of approximately 1250 ft.

Polaris Mining Co. and its successor, Hecla Mining Co., carried on 1839 ft of drifting, 126 ft of raising and 5518 ft of diamond drilling for the Coeur d'Alene Mines Corp. in the Rainbow property, owned by Coeur d'Alene Mines, west of Wallace, H. C. Mowery, president, reports. He said that two holes recently cut the vein at a vertical depth of about 160 ft below the mine's 3000 level and that both showed encouraging mineralization. The best sludge assays were 51.1 oz silver and 2.86% copper in one hole and 13.9 oz silver and 0.34% copper in the other, Dr. Mowery said.

Golconda Lead Mines, which has silver-lead-zinc holdings and a mill near Wallace has no plans for resuming mining operations because of existing metal prices, but will keep its mill in operation during 1959 for custom milling, Harry F. Magnuson, vice president, stated on be-

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Functional "years ahead" design, combined with unequalled power, makes the new series TC-12 the best all-around performer in the big tractor field. Its big power and big performance helps beat the pinch on profits...on every kind of big tractor work. Check these cost-cutting features:

Twin Engines with a total of 425 net horsepower . . . separate Torqmatic Drives each consisting of torque converter and semi-automatic transmission...more workability for heavy dozing, ripping, push-loading and towing than any other "super" tractor.

Independent Track Drives give the big TC-12 almost unbelievable mobility and maneuverability. With its separate power train and Torqmatic Drive, each track can work all the time because its power and speed is individually controlled. Operator has immediate, positive control for quick turns and side slope work.

Rigid Track Alignment is constantly maintained because each track is positioned to its main frame...each half of the tractor oscillates on a big diameter transverse shaft which provides maximum traction in rough going and increases track life. The tractor can be easily split into two halves for transport from one job to another.

Fast, Easy Operation is achieved by the separate Torqmatic Drives and simple controls. There's no master clutch...changes from one speed range to another are made under full power. Excellent visibility front and rear, and comfortable operator's seat, help to increase productive capacity. Good machine balance and stability, and "fast on its feet" performance, make the TC-12 unequalled for any big tractor work.

Service Accessibility that cuts downtime to a minimum is a feature of TC-12 design. Unitized assembly of converter, transmission and drive case components permits fast servicing or replacement without major tear-down of other parts. For example, both drive sprockets can be removed or replaced in about one-third the time required for the same work on a competitive big tractor. Planetary final drives can be serviced without breaking track or pulling sprocket.

Whatever the job, if it's a big tractor application the Euclid TC-12 will bring the best return on investment... the Euclid dealer in your territory can prove it!

EUCLID Division of General Motors, Cleveland 17, Ohio

GM GENERAL MOTORS EUCLID

EUCLID EQUIPMENT

FOR MOVING EARTH, ROCK, COAL AND ORE

Idaho *(Continued)*

half of the company's board. He said the mill operated at capacity on custom ore throughout 1958 and that the company's net earnings for the year were $106,685.

Clayton Silver Mines had a net income of $32,730 on its operations in Custer County during 1958 but lost $28,024 on its uranium operations in Utah, stockholders of the company were advised by W. M. Yeaman, president, in the annual report. The Clayton mine was operated for eight months of 1958, closed in September because of low metal prices, and recently reopened again.

ILLINOIS-KENTUCKY

Initial development of the Atwood fluorspar mine in Livingston County, Ky., on the south side of the Cumberland River, has been started by Boyce Moodie and his son, Boyce Moodie III, of Salem, operating as a partnership under the firm name of Atwood Mining Co. Installation of a washing plant has been completed, and plans call for installation of jigs within the next few weeks. It represents a particularly interesting project, according to the operators, since the area heretofore has seen no development work. Results of preliminary investigation are encouraging, the company says.

New Jersey Zinc Co. presently is engaged in a drilling operation on properties which the company has under lease and option in Pope County, Ill., west of Grand Pierre Creek.

The Alton, Ill., lead smelter of American Smelting and Refining Co. will close down in July after more than 50 years of continuous operation. Announcement of the closing was made in New York by J. D. MacKenzie, Asarco's board chairman and president, who said that the notice of termination of the smelting contract between St. Joseph Lead Co. and American Smelting had made the step imperative. The import quotas on lead and zinc, imposed by the U.S. Government last Oct. 1, were also a factor in the decision to close the plant, Mr. MacKenzie said, because the quota restrictions make it impossible to obtain an ore supply for the plant from other sources.

MICHIGAN

Walter Sterling, Cleveland-Cliffs Iron Co. president, speaking at a local meeting in Ishpeming, said: "The company is not a bit discouraged about the long-range outlook for the Marquette range. We have started our expansion of the Humboldt property to bring it up to a production level of 600,000 tons of pellets annually, and are now making plans for the next expansion of the Republic property with the new pelletizing proc-

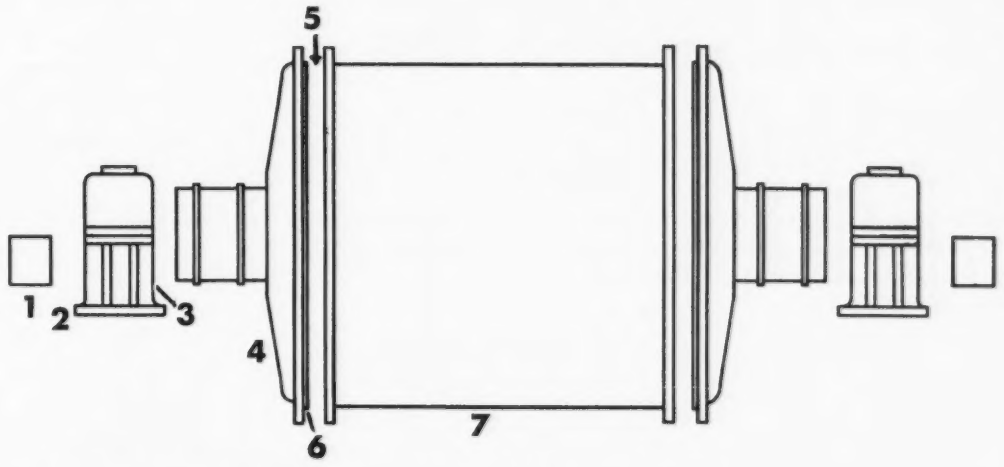
Let's take a look at the facts about grinding mills

There has been a lot of discussion about the design, types of construction, and cost of grinding mills. Here are some *facts* on the subject.

44 years ago Mine and Smelter started manufacturing Marcy Grinding Mills. These mills used the Marcy "low-pulp-line" principle of grinding. This "theory" of grinding proved itself in practice. Although many refinements have been made in the design of grates, etc., based on experience, this **basic "Marcy principle of grinding"** is still providing the most efficient grinding method available today.

Mine and Smelter has field tested many types of bearings, trunnions, lubrication, head design, etc. Thus, the present, basic design of Marcy Mills incorporates features which have been proved in practice and which have distinguished Marcy from other mills.

With reference to cost. It is obvious that the better a mill is built, the lower the operating and maintenance costs...on Marcy Mills there is "no compromise with quality."



Proved Construction Features of Marcy Mills...

1. Removable, special bronze alloy bushing; will not scour; is easy to replace. This bronze alloy has proved to be an excellent bearing material. Its use provides insurance against damage to the inside trunnion.
2. Heavy bearing sole plates dampen vibration and shock load to concrete foundation. They give rigid support for mill, without flexing.
3. Self-aligning ball and socket trunnion bearings give trouble-free operation and increase bearing life.
4. Marcy pioneered the use of Meehanite for mill heads because it has characteristics more desirable for this service than any metal now available.
5. Heads are separate from shell...if a trunnion is damaged you do not have to replace entire mill. Trunnions can be furnished separate from heads.
6. Male and female fits on flanges take shear off of bolts and assure proper alignment.
7. Heavy plate steel shell. Joints and heavy flange rings are welded with Union-Melt full penetration, continuous, automatic method, assuring uniform, strong welds.

Gears have cut teeth, are split and reversible.

Manufacturing Division

THE MINE AND SMELTER SUPPLY CO.

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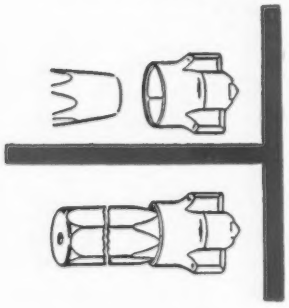
LIDDICOAT

the tungsten carbide bit that needs no resharpening

Patents applied for

Fast drilling—long life—low first cost—low cost per foot of hole drilled

The exclusive, shallow, long-life inserts need no resharpening because they do not develop a reverse taper dullness . . . a condition that stops drilling in the conventional multi-use bit. The exclusive design of LIDDICOAT permits fast drilling far beyond the point where conventional multi-use carbide bits must be withdrawn from service for resharpening. Fast drilling continues during the entire bit usage without need of resharpening.



Taper socket — No threads — Fast, firm attachment

The type TS Tee Cee Liddicoat (no resharpening) bit has a completely new, short-taper socket connection. Within the socket of the bit is a brass shim. The socket, which is completely forged, is tapered to correspond to the taper placed on the drill rod. The connection assures an absolute attachment to the rod, and yet permits easy removal.

Forged for toughness from nickle alloy steel

Bodies for Liddicoat bits are produced by forging. By a patented manufacturing process, the alloy steel is subjected to tremendous pressure which extrudes it into the desired shape. This method preserves the important grain of the steel, flow lines being compressed rather than cut across as is usual in forgings of this type. The retention of the unbroken grain and the compression of the material gives Liddicoat bits an unusually strong structure.

WESTERN
Rock Bit
Manufacturing Company
552 West 7th South Salt Lake City 1, Utah

Michigan *(Continued)*

ess. The Republic should be expanded to produce approximately 2-million tons of high grade pellets."

Quincy Mining Co. is reconditioning its No. 5 copper smelter at Ripley, which was closed about one year ago. By June, when the smelter is expected to be ready for operation, enough concentrates from the concentration plant will be on hand to keep the furnace busy for a few months.

The Groveland mine plant, M. A. Hanna Co., was completed in March. The company estimates shipments for 1959 will be about 450,000 tons. Quite a number of men from other Hanna Co. mines in Michigan and Minnesota have been transferred to the Groveland. The mine is on the Menominee range between Crystal Falls and Iron River. Total shipments for 1959 from Hanna's Michigan mines are estimated to be about 20% above the 1958 tonnage.

M. A. Hanna Co.'s Cannon, Hiawatha, Homer and Wauseca mines on the Menominee range in the Iron River district, have worked through the winter. All have accumulated stockpiles for shipment in the 1959 season.

After having been closed since July 1958, Pickands, Mather & Co.'s Buck mine at Caspian reopened in mid-April under a unique plan. The company submitted to the union a proposal which called for reopening the mine with no incentive or "contract" rates to the miners, a system which has been in effect at Minnesota iron mines from their first operation. The plan is that all miners will receive the same rate, commonly known as "company count." This is the rate paid to non-contract miners and the minimum rate paid to contract miners who fail to earn that amount under their contract rate per car. It was also stipulated that output of ore would be maintained at the level of before the shutdown.

MINNESOTA

The Hawkins open pit mine at Nashwauk is one of the Mesabi range's older properties. It was opened by the International Harvester Co. in 1902 and operated by them until 1945. The range's second commercial washing plant was constructed at the Hawkins in 1910—the same year that the Oliver Iron Mining Co. built the first plant on Trout Lake at Coleraine. Cleveland-Cliffs Iron Co. took over the Hawkins in 1947 and changed the steam locomotive haulage to a truck-belt conveyor operation. Cleveland-Cliffs completely revamped the original plant and moved it from O'Brien Lake, two miles from the pit, to the south bank of the mine. The plant now contains a heavy density section, a cyclone section and complete sizing facilities. As of April 1, 1959, the mine still contains about 2-million tons of ore.

The Zenith underground mine at Ely,

THE UNDERGROUND DIAMOND DRILL WITH HIGHEST TORQUE

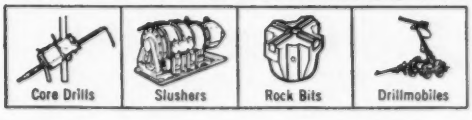
THE JOY 25

High torque in the new Joy 25 drill gives twice the rotating power of any drill in its class . . . faster penetration in any formation.

A 14 HP turbine air motor supplies the high torque through a planetary gear reduction. This power, plus a choice of maximum bit speeds from 435 to 1000 rpm, permits matching the machine to each job with utmost economy. With four rates of advance for each bit speed the driller can select the highest practical rate of bit advance for longer bit life. A new feed gear shifter changes feed rate smoothly, instantly, while the drill is rotating, and a simple friction brake permits fast retraction of the feed screw with complete safety.

The Joy 25 drills deep . . . to 625 feet with EWX fittings and 500 feet with AWX fittings. Optional equipment available with the Joy 25 drill includes choice of single-column or double-column mounting, pneumatic rod puller, (shown in picture) water pump and a complete line of drilling accessories. Get complete information on this new core and blasthole drill. Contact your Joy representative or send for bulletin 315-4.

EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY



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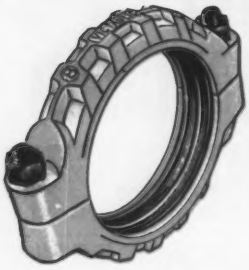
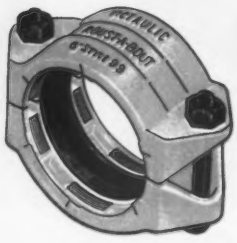


VICTAULIC COUPLINGS
Simple, fast, reliable. *Styles 77, 77-D,* for standard uses with steel or spiral pipe, — *Style 75* for light duty. Other styles for cast iron, plastic and other pipes. Sizes ¾" to 60".

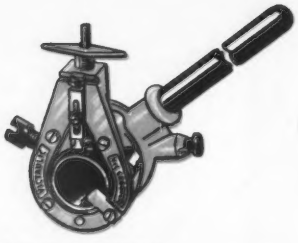


ROUST-A-BOUT COUPLINGS
For plain or beveled end pipe *Style 99.* Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 12".

VICTAULIC SNAP-JOINTS
The new, boltless, speed coupling, *Style 78.* Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

COUPLINGS FOR EVERY PIPING JOB

VICTAULIC FULL-FLOW FITTINGS
Elbows, Tees, Reducers, Laterals, *a complete line*—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes ¾" to 12".



VIC-GROOVER TOOLS
Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes ¾" to 8".

PLUS FITTINGS AND GROOVING TOOLS

"EASIEST WAY TO MAKE ENDS MEET"

Promptly available from distributor stocks coast to coast.
Write for NEW Victaulic Catalog-Manual No. C-5

VICTAULIC COMPANY OF AMERICA
P. O. BOX 509 • Elizabeth, N. J.

Minnesota *(Continued)*

Vermillion range, which had been operated by Pickands, Mather & Co. from 1920 to September 1958, when it was closed, is being reopened by the W. S. Moore Co. of Duluth and North Range Mining Co. of Negaunee, Mich. North Range is furnishing the operating personnel and the new operating company will be known as the Zenith Mining Co.

Richard Mitchell, Virginia, mining engineer for North Range on the Mesabi range, has been appointed superintendent at the Zenith and Hugh Clark, former superintendent at the Leonidas mine at Eveleth (now closed) is underground superintendent, with Arnold Norton, Crystal Falls, Mich. as mine clerk. It will require some time to get the mine back to full production. About 300 men have been interviewed for possible employment at the mine. A washing plant is being constructed to be ready for use by June. Abe Mathews Engineering Co. of Hibbing has a contract for the plant. It is estimated that about 55% of the ore mined will require beneficiation.

The Leonidas underground mine near Eveleth, operated by North Range Mining Co. since December 1954, was closed March 6, affecting about 115 men. No date was named for reopening the mine. The Leonidas was opened in 1908 by Oliver Iron Mining Co., which still operates the open pit portion of the property. About 22.7-million tons has been taken from the mine since 1909.

Erie Mining Co. has acquired the Pacific mine north-east of Aurora to add to its large taconite holdings. The Pacific was last operated by Pacific Isle Mining Co. and has been exhausted except for its taconite. It has shipped over 400,000 tons of ore since 1937.

Shipments from Great Northern Iron Ore Properties mines in 1958 were 4,436,107 tons as compared to 8,236,272 tons in 1957. Payments on the 1.5-million "certificates of beneficial interest" were $2.00 in 1958 and $3.00 in 1957. The annual report notes that imports of foreign iron ore amounted to 27% of the country's consumption in 1958; 24% in 1957 and 10% in 1952.

Cleveland-Cliffs Iron Co. has sold a substantial tonnage of Lake Superior iron ore for 1959 delivery at 1958 prices. John S. Wilbur, vice-president, sales and marine, who made the announcement, said the prices are subject to review.

Cleveland Cliffs is constructing a plant at its Holman-Cliffs mine at Taconite similar to that at its Canisteo mine in Coleraine for treatment of the fines. Completion of the plant is expected in July.

Pittsburgh Steel Co., Pittsburgh, has bought the interests in the Bennett Mining Co. formerly owned by Bethlehem Steel Corp. and Youngstown Sheet & Tube Co. and now has 78%. The remaining 22% is retained by Interlake Iron Corp. and Pickands, Mather & Co. will continue as operating agent.

FOR CONTINUOUS SERVICE IN HEAVY DIGGING

MARION 181-M

The new levels of output and efficiency made possible on operations that can use large haulage units make the Marion 181-M a logical machine for expanded pit mining operations.

Here's a husky 8-yard machine with the traditional strength, power and endurance of Marion mining shovels - - plus small machine cycle time for an extra payoff every day.

With low-maintenance Ward-Leonard controls, power is applied smoothy and quickly, yet held within controlled limits that safeguard the machine against undue shocks or strains.

The chain propel simplifies crawler design and provides increased protection for the final propel mechanism, especially on shovels where the drive chain is enclosed and dips in oil.

A disc-type air clutch permits the operator to engage the travel mechanism without stopping the machinery, permitting faster move-ups.

If you haven't seen Bulletin 439 on this 8-yard Marion, write for your copy today.

CONSULT **MARION** *MINING SPECIALISTS*

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■ Product preparation is the strongest single influence on your weekly sales, monthly volume and annual profit. If ordinary screens are giving you ordinary product quality, find out how Bee-Zee Screens are the difference between problems and profit.

Bee-Zee Screens make you money through sharper sizing, better dewatering or deliquefying, non-clogging action and resistance to abrasion. They are stainless steel, precision welded to form the right size, right shape and right dimension screen for your operation and equipment.

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ROUND-ROD SCREEN
long-life accuracy

GRIZZLY ROD SCREEN
rugged accuracy

ISO-ROD SCREEN
prolonged accuracy

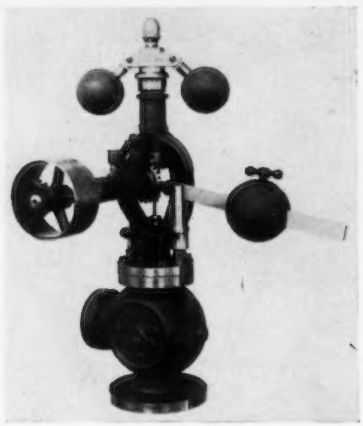
TRI-ROD SCREEN
knife-like accuracy

GRIZZLY ROD WITH SKID ROD
ruggedest accuracy

BIXBY-ZIMMER
ENGINEERING COMPANY
559 Abingdon Street, Galesburg, Illinois

THREE MEN demonstrate their new, truck mounted Gardner governor air compressor in a quarry about 1915. The compressor powers a Denver rock drill (right).

CLIFFORD V. LEECE is president of the Gardner-Denver Co., Quincy, Ill.



GARDNER GOVERNOR'S "fly-ball" steam engine regulator was the key.

Gardner-Denver Marks 100-Year Anniversary

GARDNER-DENVER CO. is marking its centennial this year, celebrating its long association with the mining and extracting industries. The firm was founded as a manufacturer of steam engine governors and expanded to become one of the world's largest producers of mining equipment.

Founded in 1859 on the banks of the Mississippi River at Quincy, Ill. by a Scottish immigrant engineer named Robert W. Gardner, Gardner-Denver was originally known as the Gardner Governor Co. Gardner Governor was a one-room shop and foundry where the steam governor invented by Gardner could be produced.

The governor was designed to regulate steam engines and keep them from breaking down, flying apart, or as they often did, running wild and even exploding due to lack of speed control. As steam power became outmoded, Gardner added an air compressor to his line and found his biggest market in the mining and petroleum industries. In 1927 Gardner Governor Co. merged with Denver Rock Drill Manufacturing Co. to produce a "package" drilling unit for mines.

On the eve of their centennial, Gardner-Denver acquired the Mayhew Machine & Supply companies, producers of seismographic and geophysical drilling equipment.

Minnesota *(Continued)*

M. A. Hanna Co. plans to reopen the North Uno mine at Hibbing for the 1959 season and the Robert and Huntington mines on the Cuyuna range. Stripping was carried on at the two mines during the winter.

Subject to change as the season progresses, shipments from Hanna Minnesota mines for 1959 are expected to be about 20% above those of 1958.

Snyder Mining Co. resumed rock stripping at the Webb and Whiteside mines in early March and 40 men have been added to the Godfrey underground mine force. At the opening of shipping season the company went from a four to five day week at its mines.

Boulder Crusher AR-180

Six of these huge crushers are being supplied for use underground in Swedish iron mines at Kiruna and Malmberget.

The AR-180 with its 71" x 55" feed opening is the largest single-toggle type Jaw Crusher in the world. It can accept blocks of iron ore up to 10 tons and reduce these to 16" thickness. It can be dismantled into component parts suitable for transportation and erection underground.

Built in three sizes

TYPE	FEED OPENING	SETTING	MIN. MINE SHAFT DIMENSIONS	NETT WEIGHT
AR–120	47" × 35"	12"	36" × 73"	81500 lbs
AR–150	59" × 47"	12"	57" × 89"	170000 lbs
AR–180	71" × 55"	16"	60" × 98"	256000 lbs

Single-toggle design — simple and strong.
Frame in sections, with interlocked bolted joints.
Side frames for the AR-180 and AR-150 are of heavy steel plate.
SKF spherical roller bearings — grease lubricated throughout — avoiding oil leakage. Low idling power consumption.

MH MORGÅRDSHAMMAR

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EFFICIENT...

WILLISON COUPLERS

The Willison has only four moving parts.

SAFE...

WILLISON COUPLERS

No need for men to go between cars to couple or uncouple.

STRONG...

WILLISON COUPLERS

Coupler and head shank are one-piece steel casting with over 400,000 pound ultimate strength.

VERSATILE...

WILLISON COUPLERS

Used on all types of mine cars and locomotives; with accessories, can couple with link-and-pin hitchings; can be used with cables on incline haulage or odd pulling requirements.

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Over 100,000 Willisons in service in the U.S. and overseas.

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Established 1868

Transportation Products Division
Cleveland 6, Ohio

International Division Headquarters
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AA-9762

Minnesota *(Continued)*

Pittsburgh Steamship Division of the U.S. Steel Corp. has announced that it will operate 51 of its 57 ore carrying vessels in 1959. In 1958 only 37 were employed. Twenty of the Division's fleet were tied up in the Duluth-Superior harbor, others wintered in lower lake ports. Wilson Marine Transit Co. will operate all 18 of its own fleet (12 in operation last year) in addition to nine it operates for Republic Steel Corp. which were also active in 1958. Crews began fitting out the ships in late March.

Inland Steel Co. was the only one of the older companies that shipped more ore in 1958 (1,548,088 tons) than in 1957 (1,424,108 tons). It was the only one that had no production from the Mesabi range and the only one to obtain all its tonnage from underground mines. Inland's 1958 operating mines were the Armour No. 1 and No. 2 on the Cuyuna range of Minnesota; the Morris and Greenwood mines on the Marquette range (Michigan) and the Bristol and Sherwood on the Menominee range of Michigan.

Pittsburgh Pacific Co., Zontelli Division, has reconditioned its plant at the Virginia mine on the Cuyuna range, idle since 1956, for operating this season. It is planned to treat ore from the Mangan-Joan mine at the plant.

The Minerals Beneficiation Sub-Section of the Minnesota AIME held its third meeting of the 1958-'59 year at Chisholm on March 25th. A paper was given by Wm. R. VanSlyke, Taconite, range metallurgist for Cleveland-Cliffs Iron Co. on "Scrubbing Iron Ore."

MONTANA

Plans to expand the Clinton Mining and Milling Co.'s present 50-ton mill near Clinton to a capacity of more than 200 tpd were announced by officials of the company.

The mill handles gold, copper, silver and lead ore mined on adjacent property by Hera Exploration Co.

Clinton officials said the expansion move was approved on the basis of known ore reserves being developed by Hera. The Hera company expects to complete a 2600 ft drift connecting the Hidden Treasure and Cape Nome mines sometime in December 1959.

Officers reelected at the annual stockholders meeting in Clinton, located near Missoula, included Thomas A. Wickes, president; W. H. Pillatos, vice president; George W. Ames, secretary-treasurer, and Arthur Brevik and Marguerite Revear, directors.

NEVADA

Kennecott Copper Corp. has announced a program of goals to be met at its smelter and mill operations at Ruth and McGill in White Pine County. To assure

NEW CASE W-5 Terraload'r

$5975
Complete with 1-cu. yd. bucket. F.O.B. factory, plus freight and taxes. Price subject to change without notice.

. . . Saves you up to $1500.00

. . . Outproduces any machine in its class!

Field tests prove the new *3000-lb. capacity* Case W-5 Terraload'r will *outproduce* any competitive machine in its class . . . *save you up to $1500* in initial cost.

73% more crowding power — Exclusive parallel hydraulic circuit, plus 30 gpm pump and specially designed tilt linkage, give the W-5 Terraload'r unequalled breakaway force of *7800 lbs.*, to speed your loading cycles.

Better balance and maneuverability — 24.2% more empty weight on rear wheels, lets you carry heaped loads at higher speeds, with less spillage. Front-wheel drive and rear-wheel power-steer permit turns within 10'4" radius.

Many other advanced features — Efficient 164-cu. in. Case gas engine, plus torque converter and forward-reverse power-shift, are just three more reasons why you can *move more tons per day at lower net cost* with the new Case W-5. See it today at your Case Industrial Dealer's, or write us direct for complete information.

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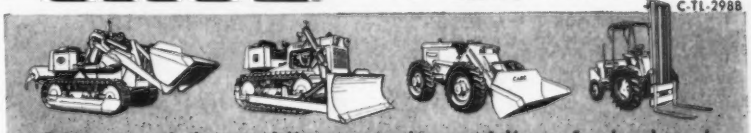

Producers of the world's most advanced line of wheel and crawler machines for earthmoving and materials handling

Nevada *(Continued)*

continued employment for the 1,500 Kennecott workers in the area, goals have been set in safety, production and costs for each of 26 two-week segments during the present year. If met, the company says they will result in maintenance of Kennecott's $20-million annual expenditure in the area. Of that amount $8-million goes for wages and salaries, $6.8-million for materials and supplies, and $5.2-million for taxes and services. Plans call for processing 21,500 tpd ore, which will return 16 lb of copper per ton plus a trace of gold and silver, according to J. C. Kinnear Jr., general manager of Nevada Mines Division of Kennecott.

American Colloid Co. is seeking patents of several claims in the Coal Canyon area of Pershing County which are known to contain large tonnages of bentonite. Requests made to the Bureau of Land Management during March ask for patents totaling 200 acres lying 10 miles north of the Mineral Basin area where Nevada's largest iron mining operations are in progress. American Colloid's claims lie close to the big highway leading to the iron mine area, which will afford an excellent access route when development starts.

Anaconda Co. operations at Weed Heights are producing 5-million lb of copper per month and maintaining a force of 450 employes who are paid $230,000 per month in wages and salaries. The figures were reported by A. E. Millar, general manager of the operations in a talk before the Yerington Chamber of Commerce during March. He said the cost of material to keep the plant in operation is $4-million annually, of which 15% is spent in Nevada. Since 1953 when the plant started, it has paid more than half of Lyon County's tax bill, and Millar estimated that the operation will continue for the next 15 years.

Goldfield Engineering Associates Inc. added a third shift to its mining operation on Columbia mountain during March, providing the Esmeralda County seat with its largest mine payroll since boom days early in the century. A total of 14 men are now employed and work is progressing satisfactorily on the crosscut in the main tunnel as well as some surface work at a higher elevation. Ore is being stockpiled and a road to the site has been completed by the county. Thomas Kelly, superintendent, says ore values are holding fairly even.

Increased Japanese purchases of Nevada iron ore were predicted during March by two visiting envoys from Kobe and Tokyo who toured the iron producing areas of the state. Chuichi Okada, attorney representing the Port of Stockton in Tokyo, and Capt. Shizukazu Onishi, of the Port of Kobe were honored guests at a dinner party given in Reno by officials of the Port of Stockton. The visitors said plans call for purchase of 5-million tons of Nevada iron ore annually for the next five years, which will be an increase of 40% over the present rate of shipments being made from Churchill, Douglas, Humboldt, Pershing and Nye Counties. Iron producers present at the dinner were Carl F. Dodge and Ernest Maupin Jr., of Dodge Construction Co., Robert O. Jones and John Harmon Jr., of Standard Slag, John M. Heizer, and P. W. Leidich. Also present were Louis Gordon, executive secretary of the Nevada Mining Assn., and Roy A. Hardy, of Getchell Mines Inc.

Anaconda Co.'s Weed Heights operation near Yerington was presented two outstanding awards during March in recognition of the accident-free year completed at the mine and mill on Dec. 31, 1958. The National Safety Council presented its Award of Merit, signed by Howard Pyle, Council president; and R. S. Newlin, Anaconda vice president in charge of operations, presented the C. F. Kelley Safety Award for 1958. He pointed out that the Lyon county mine and mill's 100% reduction in accident rate topped all the other mining divisions of the Anaconda Co. and its affiliated companies.

Miracle Mining Corp. has begun bulldozing operations to remove overburden from molybdenum and rare earth claims east of Searles station in Nye County. Joseph L. Foisie, of Alhambra, Calif., president of the firm, and Rolland Cole sampled the area early in March and results showed enough promise to warrant further development.

Thoroughbreds
for your string!

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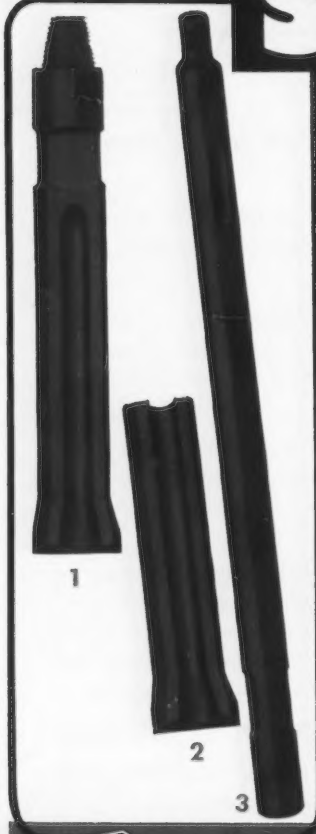
BLAST HOLE
BITS and
STEMS



Sure winners in performance and production! Spang Bits and Stems, developed by skilled experts, are a safe bet to pace the field in long service and economy. Win, place or show you can be sure with Spang.

① SPANG CHURN DRILL BITS drill more holes per bit at lower cost! Fully heat-treated, high carbon, molloy steel, or 4340 steel. They have added strength in pin and blade sections to enable them to take the toughest drilling conditions in stride. Semi-dressed ends speed finish-dressing.

② SPANG REPLACEMENT BLADE SECTIONS are for welding to the pin and collar sections of the original bit when it has become worn from long service.

③ SPANG INTEGRAL ROPE SOCKET TYPE STEMS with heat treated swivel socket and swivel. Drill more . . . drill longer for less with these rugged, efficient stems. Made from one bar of steel with only a threaded box joint with integral rope socket top the stem's uniformity cuts vibration or whipping. Tools turn freely in the open swivel socket keeping the hole round and straight.

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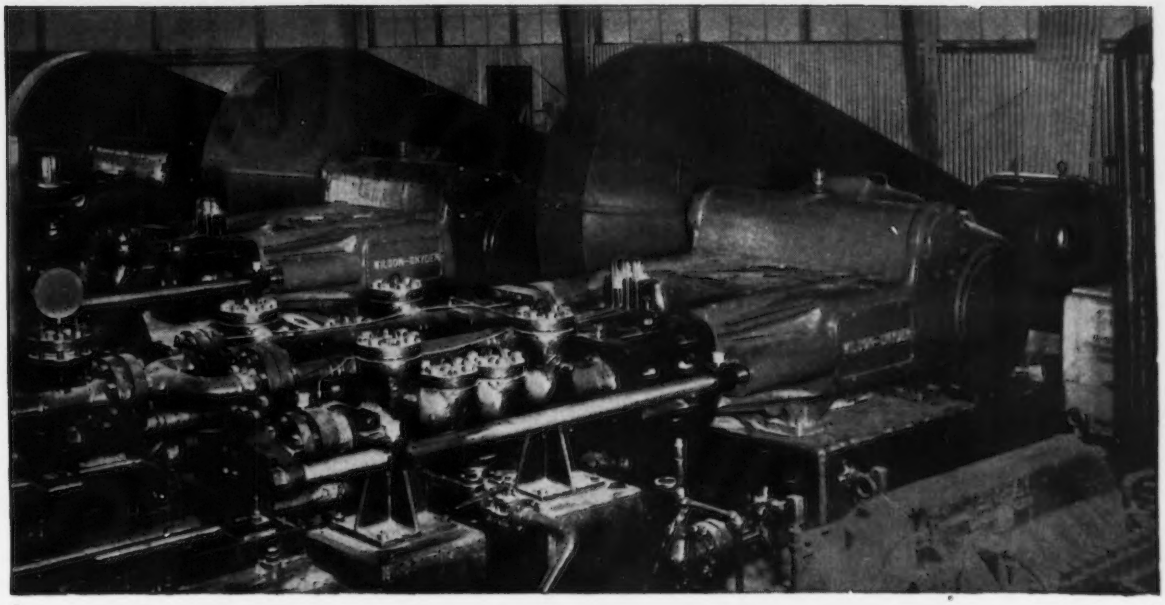
For over 60 years Manufacturers of Spang Weldless Jars and a Complete Line of Cable System Drilling and Fishing Tools for Oil and Gas Wells, Prospect Drilling and Shot Blast Holes.



Let Wilson-Snyder Engineers help you plan for SLURRY PUMPING

ALTHOUGH the pumping of slurries continues to present specific problems for every project, Wilson-Snyder has, for many years, been building pumps which excel in that kind of service.

Most noteworthy among our recent experiences in transportation of solids through pipelines, in slurry form, are these two well-known installations. We furnished the pumps for American Gilsonite Company's line from Bonanza, Utah to Gilsonite (near Grand Junction, Colorado), and also for Pittsburgh Consolidation Coal Company's line from Cadiz, Ohio to Cleveland, Ohio.

Fortified with much practical experience, Wilson-Snyder pump engineers know the basic problems in applications of this type and are more than willing to discuss them with you. We can give you valuable assistance in the application of slurry pumping equipment and show you the outstanding features of Wilson-Snyder pumps that are available for a wide range of displacements, working pressures, and fluid-end designs and materials.

Of course you'll want specialized engineering assistance for installing any slurry pumping project, but during the planning stages it just makes good sense to take advantage of our experience and testing facilities. Just write to Wilson-Snyder Works, Braddock, Pa.

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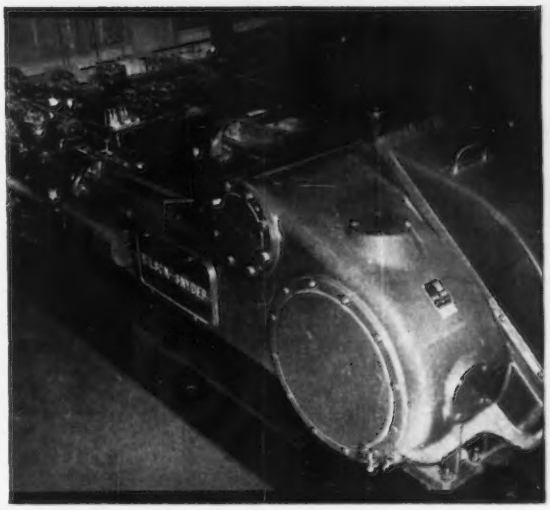


AMERICAN GILSONITE COMPANY'S pumping station at the Bonanza, Utah mines relies upon three (two operating, one stand-by) Wilson-Snyder heavy-duty plunger pumps to move 630 tons of Gilsonite per day through the 72-mile pipeline for processing near Grand Junction, Colorado. Each pump is powered by a 300-hp motor and the system is capable of handling 325 gpm of slurry at 2200 psi.

Wilson-Snyder Works
Oil Well Supply
Division of

USS **United States Steel**

ELEVEN of twenty-three impellers ordered by Societe Fria for the huge alumina project in French Guinea, which will begin output from the first stage in 1962.

Huge Equipment Aids Fria Aluminum Plant

INDICATIVE of the size of French Guinea's $133-million bauxite and alumina complex now under construction is a shipment of 23 massive agitators shown above. The venture, called Fria, is a joint Olin-Mathieson, Pechiney, Ugine, British Aluminium and Aluminium Industrie AG project, which will tap a 1.5-billion bauxite orebody. (*E&MJ*, August 1958, p 18; September 1958, p 133)

The agitators, manufactured by Denver Equipment Co., were shipped in April to West Africa. Seventeen of the agitators are 96-in. dia, and will be used to maintain suspension of minus 8 bauxite ore in an 18% solids slurry.

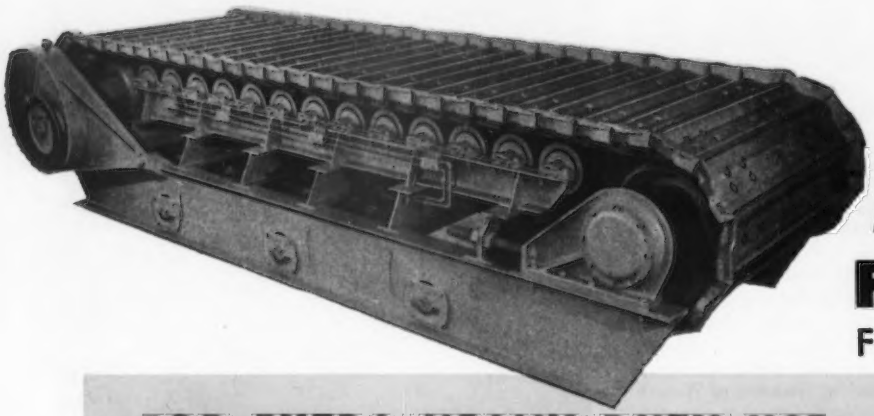
According to Denver officials, the long shaft is flanged to facilitate installation and maintenance or replacement of the propeller. Wide-spaced bearings and a massive shaft are used to withstand the extreme cantilever loading on the propeller blades that must be absorbed in the bearing housing.

Completion of the first stage of the Fria project is set for early 1962, the company says.

Nevada *(Continued)*

Gold Eagle Mining Co. has stepped up operations at its lead, silver and zinc property in the Lone Mountain mining district of Esmeralda County. A new headframe and ore bin have been built, as well as utility structures, and a compressor, hoist and electric plant have been installed. A vertical shaft has been sunk to a depth of 180 ft and about 200 ft of raises cut on the various levels. Present mining is being done on the 150-ft level where 200 ft of drifting has been completed. Ore values in the area are running better than average. Several hundred tons of good mill ore has been stockpiled. William de Carbondel, of Tonopah, has been retained as consulting geologist. The Gold Eagle Co. is owned by a group of Washington investors, and work on the firm's 15 unpatented claims has been progressing for the last two years.

Western Silica Co. which is producing and processing 80 tpd of high grade silica at its mine and plant in Esmeralda County, has announced extensive plans for expansion. Present operations are being carried out on a 24-hour basis with three men employed on each of three shifts at the site three miles east of the Lida junction. Ore is now being taken from underground stopes and trammed 300 ft to the crusher, whence it is moved to the rough ore bin.



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- Uses Mass Produced Standard Crawler Tractor Parts
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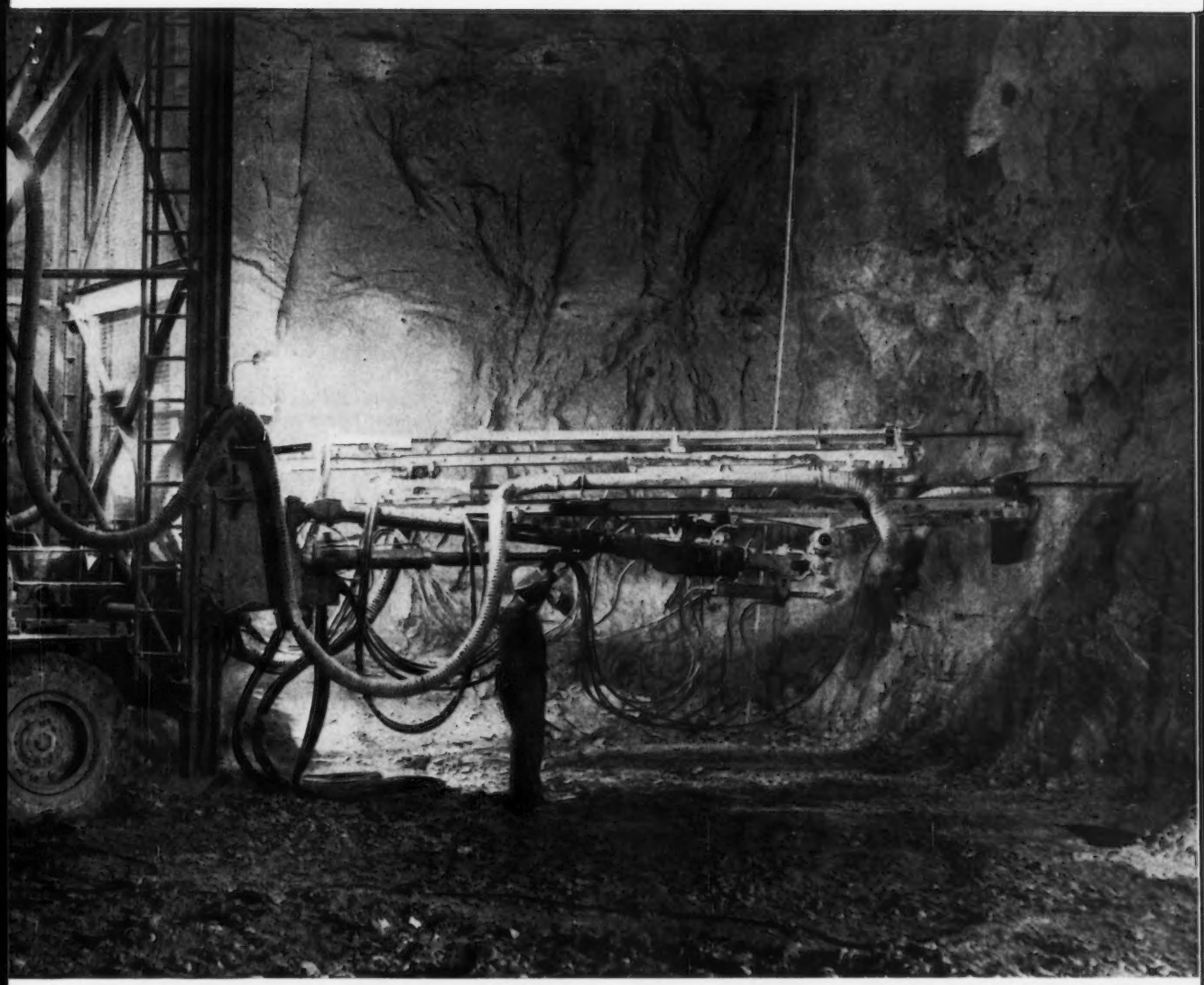

Biting deep into limestone in Mississippi River bluffs

Here Bethlehem Hollow Drill Steel is drilling a 72-hole-round, blast-hole pattern at the huge limestone quarry of Solvay Process Division, Allied Chemical Corporation; at Prairie du Rocher, Ill.

The quarry management is using the room and pillar method of rock removal. Faces in the Salem Limestone are 30 ft high, and about 50 ft wide. The Bethlehem Hollow, fitted either with one-use or carbide-insert bits, drills holes as deep as 15 ft.

You can always count on economical drilling with Bethlehem Hollow. It's tough and fatigue-resistant, and has a uniformly round hole. And having a wide quenching range, Bethlehem Hollow is easy to heat treat so that you get the right degree of toughness and wear-resistance for strong threads and long-wearing shanks.

Bethlehem Hollow Drill Steel is furnished in Carbon and Ultra-Alloy grades in rounds, hexagons, and quarter-octagons. It comes in easy to handle lengths from 18 ft to 27 ft, and longer.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

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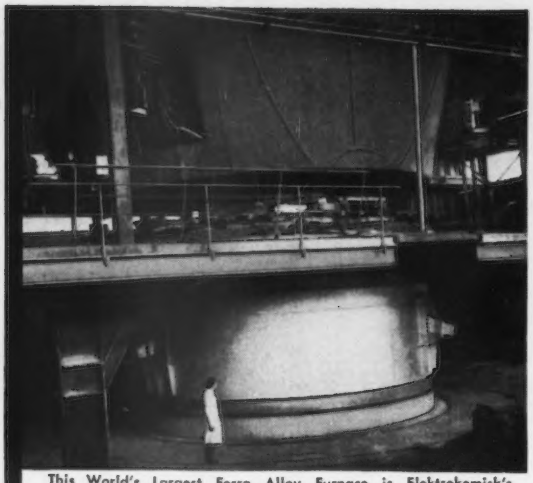
ELECTRIC SMELTING FURNACES



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Nevada *(Continued)*

A 5x26 ft tube mill using pebbles as a grinding medium reduces the material to an 80% 200 fine mesh after which it is raised by an enclosed elevator to the air classifier on top of the final storage bin. Material from 200 to 300 fine mesh is separated there as the finished product, and the coarser material goes back to the tube mill for regrinding. The finished product ships via Las Vegas.

NORTH CAROLINA

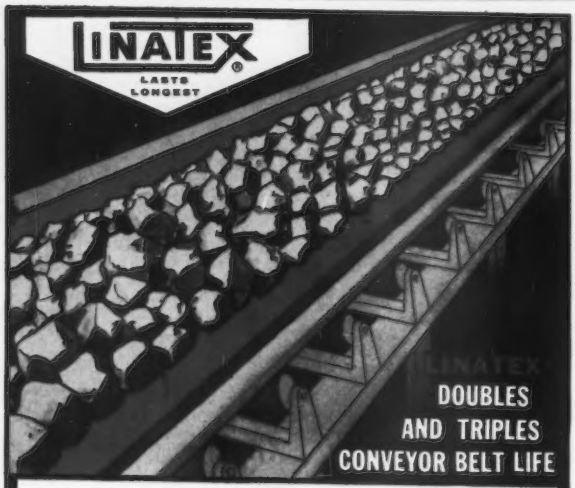
Expiration of a contract with the Atomic Energy Commission has resulted in a production cutback at the Foote Mineral Co. plant here, the nation's largest producer of spodumene mineral from which lithium is extracted.

Announcement of the cutback and operating change was made last month by Neil O. Johnson, manager of the Kings Mountain plant.

Johnson said it is the company's hope that the cutback will be temporary. "We believe there will be a substantial growth in the civilian use of lithium ore and that our mining operations will again operate at capacity."

"We are currently recovering mica from our deposit and our research department has successfully demonstrated that it is possible to recover other valuable by-products from the ore."

LINATEX
LASTS LONGEST



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Mayo's new, cast steel coupler for narrow gauge mine cars couples instantly on tangent or curves. Safe, self-centering link completely eliminates all hazards of hand couplings. Only a little more expensive than link-and-pin, it more than pays for itself by preventing accidents. If you can save one smashed finger, you've got these couplers paid for. Easily installed by bolting to existing cars. Write for Bulletin No. 22A.

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Mine Cars
Grouters

A report on 3 years' experience loading boulders

Rubber-Tired Michigan increases output 35%

All over the world, more and more earthmovers are finding Michigan Tractor Shovels can effectively handle jobs once considered much too difficult for rubber-tired equipment.

You've probably read about—or seen—Michigans digging pit-run gravel. Or breaking out reinforced concrete. Or clearing trees and tangled brush. Now here's another dramatic application.

Crawlers slow

The company involved had always had trouble moving traprock and dolomite from pit to crusher. Crawlers were too slow to readily maintain increasing production requirements. So, management decided to try a high-speed Michigan Tractor Shovel.

Repairs reduced 50%

That was in 1954. Today, this company owns *six Michigan Tractor Shovels!* These units handle *all* rock cleanup—moving thousands of tons of traprock, dolomite, and limestone. They also handle truck-loading of screened aggregates and other products of the multi-million-ton crushed stone plant. Management estimates output per Michigan "at least 35% greater" than output of each loader formerly used. Maintenance costs, over periods ranging up to three years, "have been cut in half!"

Boulders weigh 1 to 3 tons each

Note the photo above. Here, one of the company's five 2¾ yard Michigan Model 175A's is handling the rock. Each rock weighs 1 to 3 tons, yet at no time have the Michigan operators reported trouble loading or carrying them.

Load 10 tons in 2 to 3 minutes

On aggregate loading, the company keeps its 2 yard Model 125A busy (and any of the Model 175A's not loading rock). Here, unexcelled breakout makes quick work of the job. The Model 125A needs only 3 minutes to heap a typical 10 yard truck . . . the bigger Model 175A's usually take a minute *less* than that.

27 mph travel speeds odd jobs

Michigan speed pays off on odd jobs, too. Like cleanup of haul roads, pit floor, stockpiles, and around crushers. Pushing loaded trucks up grade. Hoisting heavy equipment. Switching railroad cars. Despite year-around work averaging 50 hours a week, company officials report "downtime negligible." And continuing, "We like the speed of loading, the truck-like speed between job sites, and the ease of maintenance. That is why we've been repeat-buyers five times!"

Your local Michigan distributor will be glad to show you why you too should be a Michigan buyer. Write him for all the facts.

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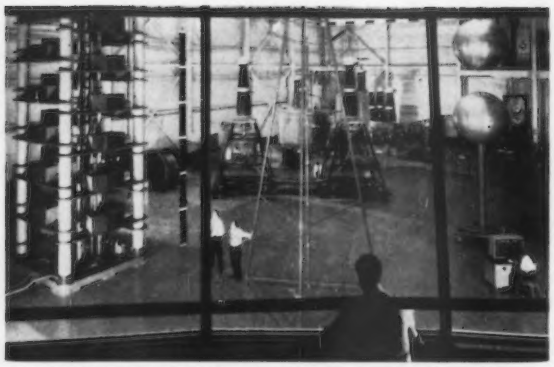
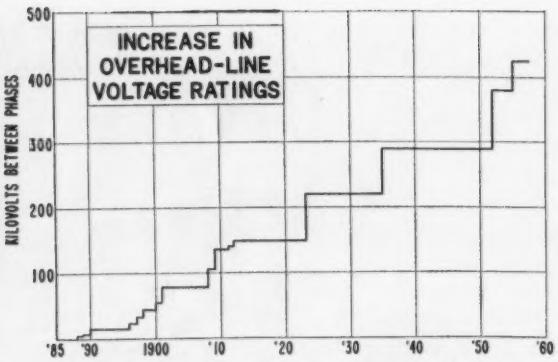


ANACONDA'S LABORATORY is designed to develop 3-million-v impulses to test cables designed for future power circuits.



TREND TOWARD higher transmission-line voltage motivated Anaconda to test and design super-insulation cables.

Anaconda Wire Researches New Copper Uses

CONVENTIONAL POWER CABLE DESIGNS will be completely inadequate to transmit extra-high-voltage currents (EHV) which future power circuits will require. The accompanying chart shows the trend toward higher cable voltage ratings. In recognition of this fact, L. F. Hickernell, vice president of Anaconda Wire & Cable Co. and president of the American Institute of Electrical Engineers, told reporters that Anaconda had invested $1.75-million in a modern research laboratory at its Hastings-on-Hudson plant to test and develop cables that will be able to carry the EHV currents of future power circuits.

Engineers of the Anaconda subsidiary designed the laboratory shown above. Equipment includes a generator capable of delivering a 3-million-v impulse current, a 750,000-v transformer set, and a 200-cm gap for measuring EVH voltages. The two spheres shown at right on the photo constitute the adjustable gap that is required to measure EVH voltages. No other instrument can do this.

At extra high voltage levels, cable design is extremely intricate. Every molecule of water must be evacuated from the insulation material covering the copper conductors. To do this, the assembled cables are placed in a steel tank under high vacuum to draw off all moisture content. Then the cable is impregnated with a non-conducting oil under high pressure in the same tank to increase the insulating capacity of the conductor.

Two types of cable were on exhibit at the Anaconda Wire & Cable Co. plant: One type with a spiral brass skid wire for installation in steel conduits, and a second with lead sheathing for cables to be buried underground. Engineers were asked whether the dense molecular structure of lead might enhance its application in the EHV field. Their reply was that more research would be required to answer this question, but that this new outlet for lead had definite possibilities.

Current for the cable tests is supplied through a 500-amp germanium rectifier. In tests run to date, cables have been blown up under high voltages, demonstrating the inadequacy of present designs to meet EHV requirements.

STRUCTURAL STEELWORK for Kennecott Refining Corp.'s refinery dominates the scene near Baltimore. Tank house is at right, administration under way at left.

New Kennecott Refinery Is Due This Year

IMPROVED weather conditions will accelerate construction of the 16,500-ton per month electrolytic copper refinery near Baltimore, Md. which M. W. Kellogg Co. is constructing for Kennecott Refining Corp.

The totally integrated refinery, located in Anne Arundel County, is expected to be in operation later this year, according to I. G. Pickering, project manager for Kennecott Refining. Modern materials handling is being "built-in."

TENNESSEE

American Zinc, Lead and Smelting Co. has reported ore reserves of 85-million tons in East Tennessee. In their annual report for 1958, American Zinc indicated they expect to produce a minimum of 4.7-million tons of 60% zinc concentrates from this ore reserve. Of this total, 2.5-million tons of concentrates were found by DMEA Development projects at Strawberry Plains and West New Market, in Jefferson County, Tenn. The remaining ore reserves, reported to grade 3½% zinc, are located at American Zinc's five mines in Knox and Jefferson Counties.

International Minerals Co. is moving into the Sweetwater barite district. During the last few months, International Minerals has exercised options to purchase the Beverly Wood barite holdings near Sweetwater, Tennessee. This is the second large company to purchase an operating mine in this district of chemical grade barite. In 1956, National Lead Co. bought some producing properties near Sweetwater but subsequently shut them down.

Rep. Howard Baker (R—Tenn.) said he plans to introduce a bill to levy import duties on lead and zinc if the import quotas imposed by the President last fall don't raise domestic zinc prices to the "peril point" level of 12½ to 13c.

Baker revealed his plans in commenting on a one-year lead and zinc subsidy bill introduced by Sen. Gordon Allott (R—Colo.) that would allow lead miners

annual filter

Tennessee *(Continued)*

YOU'LL NEVER BURN OUT AN AIR TOOL

with the new Le Roi LO-380 line oiler...

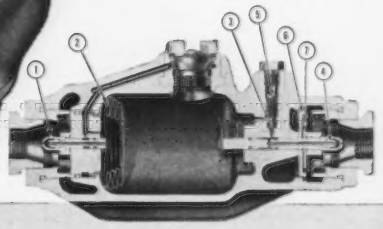
Here's how the LO-380 Saves Tools—Cuts Repairs!

(1) Inlet reed valve meters air into the oil-resistant bellows (2) which creates pressure that forces regulated amount of oil through porting connected to the needle valve (3) and the porting connecting it to the outlet reed valve (4) through which oil is injected into the air stream.

(5) Set screw permits easy external adjustment of oil feed during operation.

(6) Positive pressure differential valve assures correct oil feed for all air flows — eliminates oil waste.

(7) Shut-off valve automatically stops air when oiler is empty. As oil supply goes down, bellows (2) expand and contact the shut-off plunger, depressing it until the valve reaches the automatic shut-off position.



EMPTY OILER SHUTS OFF AIR!

That's right! *You'll never burn out an air tool with the new Le Roi LO-380 on the job!* When the oiler runs dry, it automatically shuts off the air! The "no oil — no air" design prevents unnecessary wear on critical parts — cuts repair bills — extends tool life!

The new line oiler assures positive lubrication for air tools — delivers a steady mist of oil at 10 to 150 psi — and keeps it flowing until you shut the air off, or until the empty oiler shuts it off automatically. Metered oil flow provides exceptional economy, prevents oil splurges. As a matter of fact, the LO-380 will pay for itself in a short time through oil savings alone!

Oiler permits easy external adjustment of oil feed — provides full one-pint capacity. Lightweight—only 9 lbs.—it's easy to use, easy to move—operates in any position. Oiler can be refilled under pressure while air tool is in operation.

Contact your nearest Le Roi distributor for details — or write to Le Roi Division, Westinghouse Air Brake Co., Milwaukee 1, Wisconsin.

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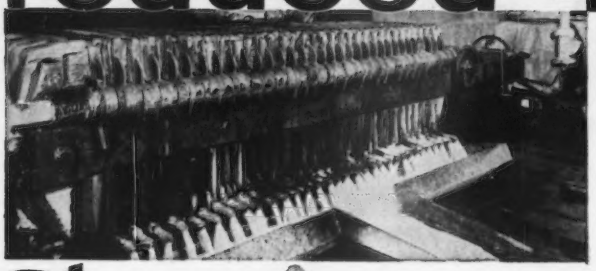
PORTABLE AND TRACTAIR® AIR COMPRESSORS • STATIONARY AIR COMPRESSORS • AIR TOOLS

AT-906

annual filter paper costs reduced 41%



at ANACONDA® with NETONE FILTER PAPER

- *Netone has service life of 12 cycles (old paper lasted one cycle)*
- *Easier to put on filter press, less installation damage*
- *Shows excellent resistance to solution shock*

At The Anaconda Company, Electrolytic Zinc Plant, located at Anaconda, Montana, Netone filter paper has been used exclusively on the Shriver filter presses since January 1, 1955. Netone is a heavy, neoprene filled paper possessing remarkable wet strength characteristics.

Prior to the use of the Netone paper on the Shriver presses, it was necessary to discard the kraft paper sheets then in use each time a press was cleaned. The life of the Netone paper in the same service is an average of 12 press cycles. Due to its greater wet strength, the Netone paper is less apt to be damaged during installation and has greater resistance to rupture from solution shock when the press is put in service.

Annual filter paper costs have been reduced 41%. The savings in labor and filter down time are also considerable.

Why not try NETONE Filter Paper on your filter? Test samples on request, no obligation, of course.

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Toronto: Lee Benner Chem., C. P. R. Roadway, 1119 Yonge Street

Mexico City: Maquinaria Minera, Apartado Postal #215
Cincinnati, Ohio: Roselawn Center Bldg.
Houston, Texas: 1607 Jefferson Ave.
Pensacola, Fla.: Chem-Quip Co., 1102 Texar Drive
Montreal: Lee Benner Chem., 4700 Prince of Wales

Tennessee *(Continued)*

the difference between market price and 16c a lb and zinc miners the difference between market price and 13½c a lb. Quantity subsidized would be limited to 500 tons per quarter per mine.

The real answer to the lead and zinc problem, according to Rep. Baker, member of the powerful House Ways and Means Committee, was offered last summer by the Tariff Commission, which proposed a reasonable increase in tariff to insure a domestic zinc price of 12½c a lb. This approach is superior, he thinks, to a direct subsidy which should be used only in extreme cases to keep the industry from going completely out of business.

UTAH

Cerro de Pasco Corp., New York City, has entered into an agreement with Chief Consolidated Mining Co. and Armet Corp. calling for possible development of silver properties in the area of the Holt Mine, Iron County. The extent of Cerro's participation in the venture may aggregate as much as $950,000 depending upon results obtained at successive stages of the mine's development. (*E&MJ, April, p162*)

Cecil Fitch, Jr., president of Chief Consolidated, said that some 4,361 ft of diamond drilling, which indicated a possible ore body of some 300,000 tons averaging 30 oz silver, had been completed prior to Cerro de Pasco joining the venture.

The agreement with Cerro is on a "step by step basis," he explained.

"The first step will be an additional 4500 ft of drilling and extending the depth of a small shaft already on the property by an additional 150 ft. These two operations are now proceeding.

The core drilling will check the original testing and reserve evaluation of the Chief and Armet company, as well as to extend the proved ore reserve. The shaft sinking will determine the amount of water with which the operators will have to deal, Fitch reported.

"Should this latter step prove encouraging, a second shaft will be sunk before extensive drifting takes place," Fitch related.

Concerning the agreement with Cerro de Pasco, Fitch said that "our company (the Chief) will not be required to furnish additional capital until Cerro de Pasco has advanced up to $950,000 in developing this property and/or other properties within a radius of 50 miles which we have an option to purchase. Work on 'Step One' has already begun and we should have the results within the next four months.

"Under the terms of our agreements, Cerro will eventually acquire a 51% interest in this property and Chief and the Armet Co. will each own 24½% interest. Before acquiring a 51% interest, Cerro has the right to withdraw from the agreement, but does not have the right to be reimbursed for any monies expended or contracted for as of the

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Utah *(Continued)*

date they withdrew, except should Cerro after acquiring a 25% interest, but before they acquire 51% interest, desire to withdraw—then Cerro will receive 4% of the metal produced until such times as they have been fully reimbursed for monies actually expended," he said.

United Park City Mines Co., one of Utah's major lead-silver-zinc producers, reported continued losses during 1958.

While the grade of ore generally increased, lower average metal prices contributed to lack of profits.

An increase in copper values caused comment—largely because New Park Mining Co., another operator in the Park City District is engaged in a $750,000 exploration project seeking an increase in these values in western segments of its properties.

UPC vice president and general manager S. K. Droubay said that the firm had a net loss of $101,264 before depletion for 1958 compared with a loss of $88,119 in 1957. Ore sales were $1,904,304 last year versus $2,263,137 the previous 12 months.

The company was able to maintain ore reserves at one new ton for each ton mined during 1958, through short-range exploration.

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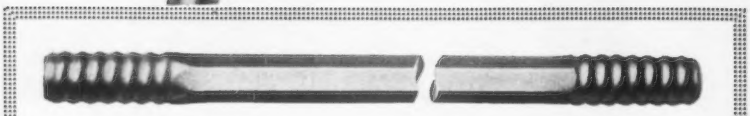

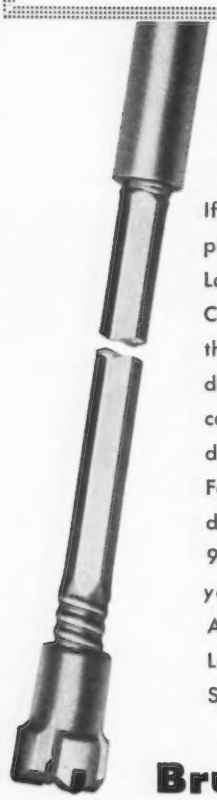

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WASHINGTON

Daybreak Uranium, Inc., Spokane, resumed work April 1 at its Dahl lease in the Mount Spokane mining district. A crew has drained water from the company's open pit uranium mine in preparation for driving a new tunnel in a 4-ft face of ore exposed in the wall of the pit.

A new open pit operation was to be started later in April on adjoining land. Work will be done in an ore zone discovered last fall by drilling and bulldozing.

Gold mining operations were to resume in the Blewett pass area between Wenatchee and Ellensburg, about May 1 by North American Exploration Co., Seattle.

Work will be done along Culver and Nigger creeks in the Blewett area. Officials of the company said the development work would cost about $300,000.

Mining and hauling operations were due at the Spokane Indian reservation May 1 by Dawn Mining Co., a subsidiary of Newmont Mining Corp., according to J. J. Crowhurst, Dawn manager.

Road restrictions between the reservation mining operations and the company's uranium processing mill at Ford were expected to be removed by that time, Crowhurst said.

Mining and hauling operations were halted Dec. 20 because a large stockpile had been built up at the mill. Stripping work at the reservation was started April 1 by Isbell Construction Co., Reno, Nev., to remove waste material from orebodies.

Crowhurst said that the mill operated on a three shift basis all through the winter except for two weeks in December. It has been handling about 400 to 500 tons of ore every 24 hours.

WYOMING

Western Uranium Corp. of Belle Fourche, S. D., has started stripping operations to extend and deepen its pit in the East Gas Hills area of Fremont County.

When completed in April, the extension will have moved about 350,000 yd of overburden and deepened the pit from 115 to 170 ft.

General manager Wayne Erickson said mining will be resumed when the pit extension hits the first ore horizon. Chapman and Morehouse of Grand Junction, Colo., will conduct mining operations.

IN CANADA

BRITISH COLUMBIA

Disclosure of a deal between Nimpkish Iron Mines Ltd. and Japanese importers revealed that movement of British Columbia iron ore to Japan is running

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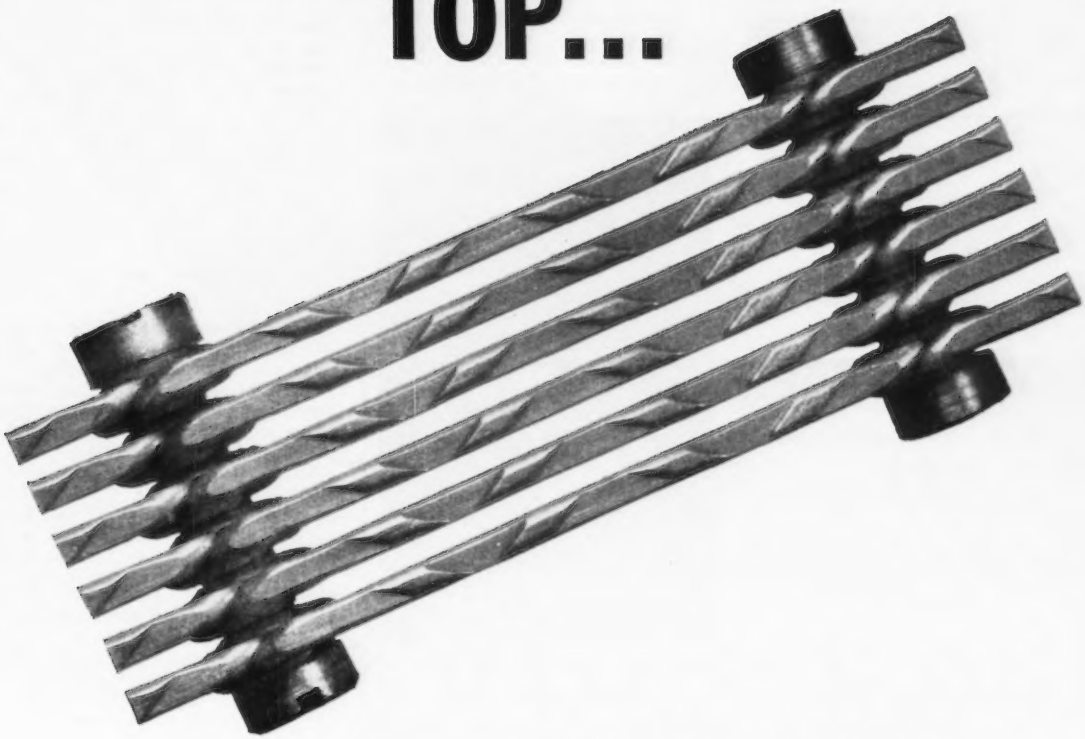

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B.C. *(Continued)*

into a $30- to $40-million business. The company will spend approximately $2-million putting its Vancouver Island property into production and shipments to Japan will begin by mid-year. The initial contract calls for 1-million tons of ore and the whole deal may run up to five years. The ore will be moved 26 miles to tidewater at Beaver Cove, where conveying equipment and bulk loading facilities will be installed by Canadian Forest Products railway. It is estimated that $1-million will be spent on crushing, screening, and concentrating equipment and on a camp which must be built at the mine site. Another million will be spent to bring the project into complete operation.

Nimpkish is owned by two companies, Standard International Mines, a Canadian subsidiary of Standard Slag Co., of Youngstown, Ohio (who have a majority interest), and International Iron Mines, a Canadian company. The Japanese companies involved have no financial interest in the Nimpkish operation.

Nimpkish is the third British Columbia firm to export ore to Japan. Texada Mines Ltd. has shipped more than 1.5-million tons since 1952 and Empire Development Co. Ltd. has exported 300,000 tons of iron concentrates and expects to ship a total contract worth $10 to 12-million.

Howe Sound Co. reports geological studies have laid the foundation for an exploration program at Britannia copper mine which will be carried out simultaneously with present production. The annual report showed net income for 1958 to be $1,894,210, gross revenue $61,142,230 and expenditures $58,915,-612. Britannia produced 750 tpd of ore in February and expects to reach 1,200 in April.

Bethlehem Copper Corp. Ltd. is speeding up its Highland Valley exploration program for September completion. Higher grade ore than had been expected has been reported, and a tunnel is being driven through the Jersey orebody and a series of drifts are being extended north and south across the orebody to permit detailed sampling. The tunnel will then be continued to the higher grade East Jersey zone, where a similar program is to be conducted. The Jersey tunnel has now advanced 550 ft.

Granby Mining Co. Ltd. is in the process of reopening its Phoenix copper mine which has been closed since 1919. A crew of 40 to 50 men are now reconditioning the smelter at Grand Forks, where work has been going forward to prepare the mine for production. It is expected that the mine will produce 5,000 tons of ore a week, the mill operating day and night. With the use of open-pit methods, the mine is expected to produce ore for about five years. American Smelting & Refining Co. will receive between 100 and 200 tons of concentrates each week at its smelter in Tacoma.

Granduc Mines Ltd., which is substantially owned by Granby, has no plans for production this year.

NEW BRUNSWICK

Consolidated Mining and Smelting Co. has decided to go underground on its copper property, located some 28 miles southwest of Bathurst. The decision follows two years of exploration, which resulted in indicating an orebody of moderate size and grade, with extension still open to depth. It is planned to sink a shaft to an initial depth of 1150 ft with lateral development to be carried out on the 500-ft and 900-ft horizons.

NEWFOUNDLAND

Atlantic Coast Copper Corp. is commencing development of the 400, 550, 700 and 850-ft levels at its copper property at Little Bay. Study of ore treatment is also being undertaken. Final decision on mill and production operations will be made following the present underground program and ore studies. During the past year a shaft was sunk to 1,050-ft depth and lateral work and diamond drilling were carried out on the 1,000-ft horizon.

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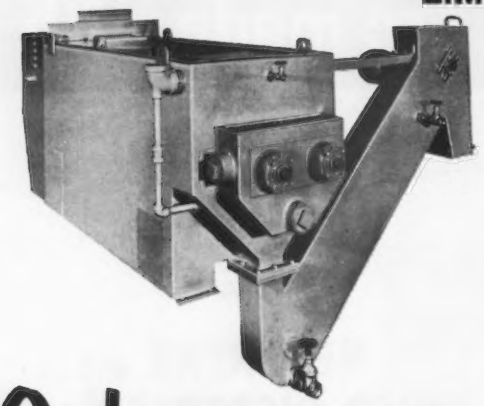

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MANITOBA

On the basis of a contract with Metallgesellschaft A.G. of Frankfurt, Germany for amblygonite ore, underground operations at Montgary initiated around April 15 with the first 1,000 tons of ore expected to be shipped within three to four months.

In conjunction, an exclusive sales agency agreement has been negotiated between Montgary Explorations Ltd. Toronto and Metallgesellschaft A.G., Frankfurt and W. R. Grace & Co., New York.

Maralgo Mines reports it is selling its Mystery-Moak Lake nickel property to International Nickel Co. for $750,000. Gaitwin Explorations which held the 70 claim property originally will get 25% of this.

Hudson Bay Mining & Smelting Co. reports net profit for 1958 was 8% lower than in 1957. Earnings amounted to $7,392,888, or $2.68 per share compared with $8,039,303, or $2.91 per share in 1957. This was due to lower metal prices as tonnage of ore treated and metals produced all showed increases. Ore reserves are reported as 18,245,500 tons. The company anticipates that production rates will be maintained at the same rate and that development on its Chisel Lake Mine and Stall Lake Mine will be expedited in 1959.

International Nickel reports that the sinking of the 2100 ft production shaft and 1057 ft development shaft at Thompson Lake was completed during 1958. The smelter output is scheduled to start in July 1960. Mine development and plant and town construction are proceeding ahead of schedule.

Sudbay Exploration and Mining reports it will commence diamond drilling of a beryllium prospect in the Winnipeg River area this spring.

ONTARIO

Steep Rock Iron Mines expects that this year's output from the company's Steep Rock iron mining operations will be double the 1,156,358 tons shipped in 1957. Both of the new concentrators, installed last year, are being utilized and will permit shipment of better grade ore.

Lowphos Ore Ltd, a subsidiary of National Steel Corp., has started operation of its new iron ore beneficiating plant at Moose Mountain near Sudbury. The plant is designed to turn out 550,000 tons of iron ore concentrates per year. It handles around 3,500 tons of magnetite per day for output of about 1,700 tons of concentrate. Crude ore grades 30-32% iron with concentrate at about 65%.

Inland Steel Co.'s Caland Ore Co. Ltd. has completed about 75% of the total dredging yardage required on its

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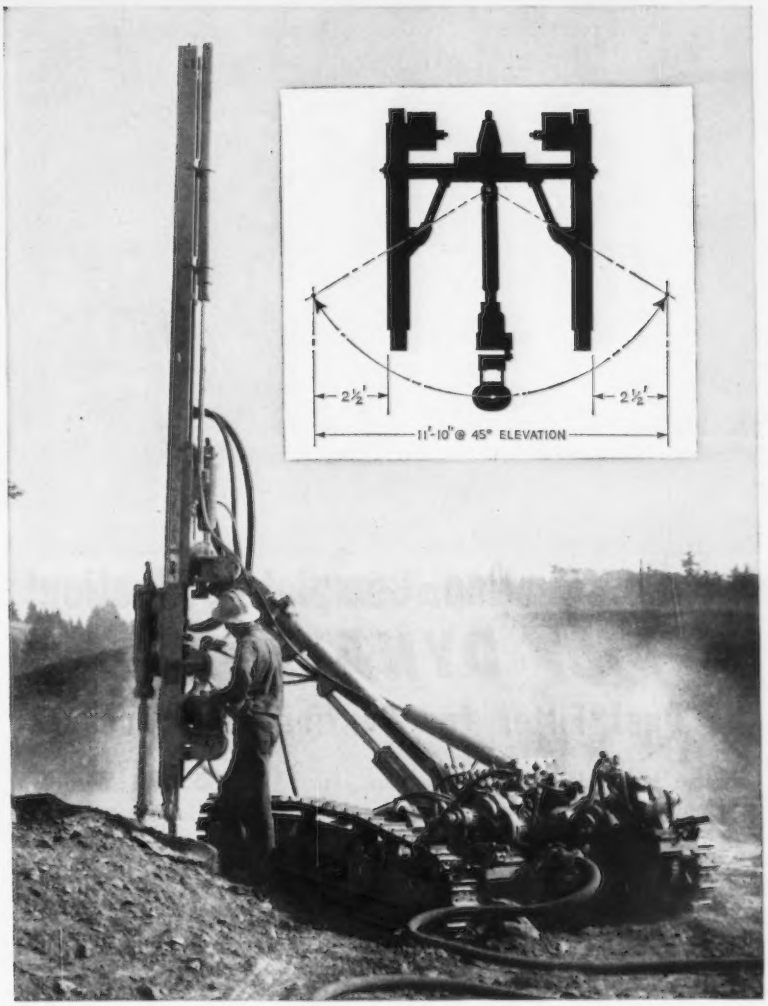

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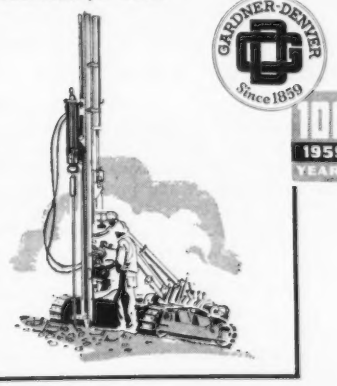

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Ontario *(Continued)*

"C" orebody lease from Steep Rock. It has uncovered some high grade ore in the upper horizons. Construction is well advanced on surface buildings and plant and a shaft has been sunk to 1340 ft. Open pit mining equipment has been ordered and, after 1959's stripping operations, ore shipments are expected to begin in 1960. Minimum royalties to Steep Rock build up from 750,000 tons in 1960 to 3-million tons per year.

North American Rare Metals has embarked on a $1-million development program for its Temagami area iron property. A 3-compartment shaft is going down to an initial depth of 1,250 ft and a minimum of 4,000 ft of lateral work is scheduled to be carried out on the 1,200-ft horizon, together with a heavy program of diamond drilling. Surface diamond drilling has indicated an orebody 7,800 ft long and still open, 400-500 ft wide and grading about 31% iron to depth of 1,000 ft below a 750-ft diabase capping. Tonnage has been estimated to be at least 400 million tons.

Dome Mines celebrated its 50th anniversary since its staking in 1909. The big Timmins area gold producer is still going strong with production in 1958 topping the $5.9-million mark. Ore reserves are still ample at 2.4-million tons.

The Province of Ontario's Department of Mines has awarded Spartan Air Services Ltd. of Ottawa a contract to carry out the largest single government sponsored airborne magnetic survey ever to be carried out in Canada.

The announcement was made at the annual meeting of the Canadian Institute of Mining and Metallurgy in Montreal.

The airborne geological search of 60,000 square miles of Northern Ontario is to be carried out under Ontario's "Roads to Resources" program. The Ontario Government will bear the major portion of the $400,000 survey cost. The area to be surveyed is north of the Canadian National trans-Canada rail line between Nakina-Armstrong and Sioux Lookout north of Lake Superior.

Survey results will be produced in 160 individual map sheets, each of which will be reproduced 1,000 times for delivery to the Ontario Department of Mines over the next 18 months.

QUEBEC

Shipments of titanium slag and iron by Quebec Iron and Titanium Corp. from its Allard Lake operations were 51% less in 1958 than in the previous year. As a result of a drop in demand for titanium slag and a resultant increase in inventories, plant operations were closed down last October. They were resumed in April of this year at 50% or better of total capacity. Sales have indicated recovery to date this year. The expansion program, which increased the number of furnaces from five to eight and

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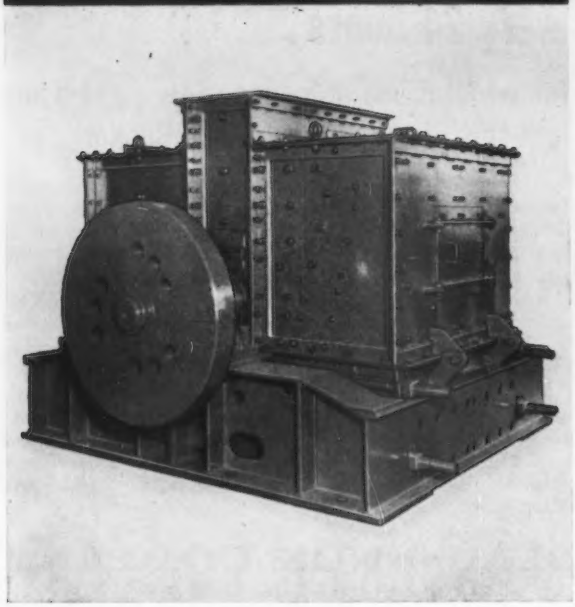

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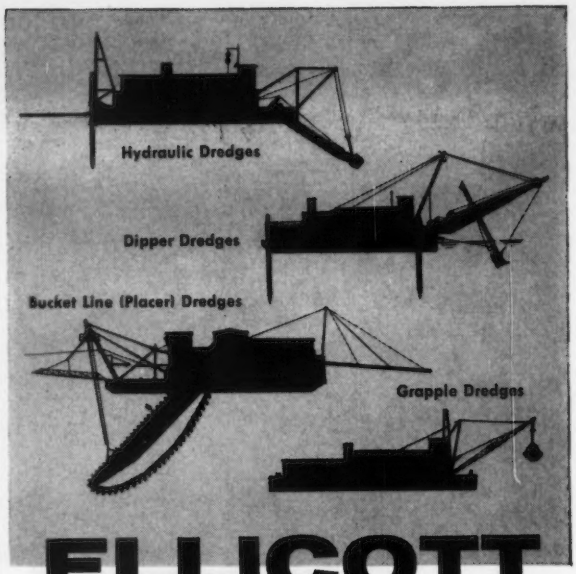

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Quebec *(Continued)*

added auxiliary equipment, was substantially completed in 1958.

Roberval Mining Co. has optioned its 105-claim iron prospect in Lyonne Twp., some 42 miles from Roberval, to Oglebay, Norton & Co., a Cleveland iron ore firm. Work on the group to date has indicated over 100-million tons of low grade concentrating-type open pit ore. Exploration by Oglebay, it is understood, will consist of a minimum of 10,000 ft of diamond drilling in addition to metallurgical and treatment tests now in progress.

IN LATIN AMERICA

CHILE

Since the copper smelter and electrolytic refinery to be constructed at Ventanas near the port of Valparaiso, cannot be built because of lack of funds, the Senate passed a motion put forward by Senator Videla Lira, president of the Mining Society of Chile and also president of the Senate, authorizing the National Smelters Corp. to bid for a loan up to $40-million to build the smelter, electrolytic refinery and sulphuric acid plant. This proposal has been approved by the present Administration.

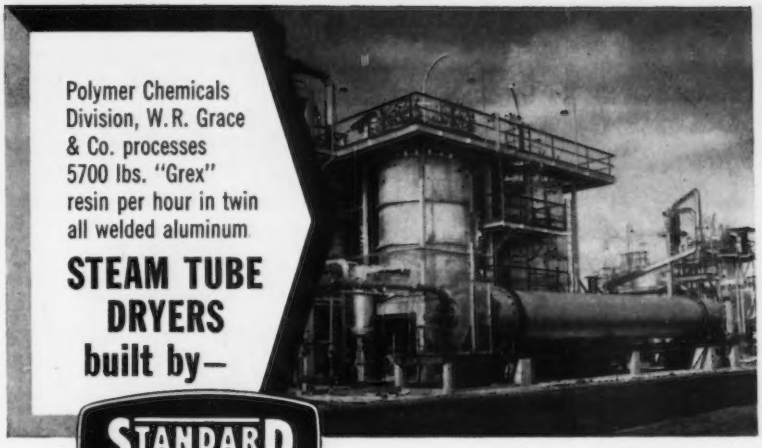
The government has approved a plan put forward by a UN mining engineer, J. S. Carman to carry out the geological investigation of the northern provinces of Tarapaca, Antofagasta, Atacama and Coquimbo and make the detailed geological maps at a scale of 1 : 50,000. The work will require nine geological teams in the field and may be finished by 1962. It will cost $2-million since practically the whole of the equipment will have to be imported as well as the geologists. The Chilean government will pay for the expenses to be incurred in Chilean currency.

The Paipote copper smelter made during 1958, 19,940 metric tons of blister, which contained 28,500 oz of gold and 223,000 oz silver with a total value close to $14-million, saving the country $2-million in foreign exchange.

Output of molybdenum in Chile increased from 2,589,000 lbs in 1957 to 2,992,000 lb in 1958. Exports from Chile during the year decreased to 1,767 short tons; 2,778 tons was exported in 1957. Stocks of molybdenite on hand as of Dec. 31, 1958, totaled 770 tons.

ARGENTINA

In connection with the recent international tender call for the exploitation of the 200,000 ton iron ore deposit at Sierra Grande, in the Rio Negro prov-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Philippines *(Continued)*

and 2,000 metric tons of pyrite to the National Power Co.

Surigao Consolidated and Santa Teresita Mining Co. have concluded a contract authorizing the former to operate Santa Teresita's iron ore mines in Manboanga de Sur. The property is about two miles from the main orebody of the Pioneer Mining Co., for which Surigao Cons. also has the operating contract. This marks the entry of this long established gold producer into the iron mining field. All ore will be shipped to Japan. J. B. Harrison is in charge.

Marinduque Iron Mines is shipping high grade iron ore from Taluntuan, Marinduque, of excellent grade. The same company is making direct shipments of copper ore from its Samar property, as well as copper concentrates from its Sipalay mine in Occidental Negros.

Marsman & Co.'s Itogon-Suyoc property is encountering higher grade gold ore in the Itogon mine and reports a larger gold recovery. At the Suyoc property mill construction is being accelerated. The ball mill section is ready and work is nearing completion on the cyanide plant. Rehabilitation of the mine workings is progressing rapidly.

According to preliminary reports, Benguet Consolidated ranked first in value of its production in 1958 among Philippine mining companies, followed by Atlas Consolidated, Lepanto Consolidated, Philippine Iron Mines, and Consolidated Mines in order. Benguet's output was valued at $13.4-million but this was priced at the open market for gold, now the equivalent of $70 an oz in Philippine pesos. On a statutory basis, the value of Benguet's production would have been less than the others listed.

IN AUSTRALIA

Mt. Isa Mines Ltd. of Queensland, has begun expanding its copper smelter at a cost of $8.2-million and will double capacity to 80,000 tons a year. Work will also begin before the end of 1959 to increase capacity of the new Townsville refinery from 40,000 to 60,000 tons copper a year.

The company's development activities within the last three years involved an expenditure of close to $50-million. Current mine throughput is running at rate of about 6,600 tpd of ore and by June will be increased to 8,000 tpd. Daily production will eventually be raised to 13,500 tpd. A further expansion of copper smeltering activities is envisaged at a later stage to bring the production rate to 100,000 tons a year.

Mt. Harris Tin Mines N.L. intends to begin costeaning (trenching) to test its property in the Northern Territory. The program will comprise five costeans over a total length of 1,000 ft. The company has asked the Bureau of Mineral Resources to help test the Jessop lode.

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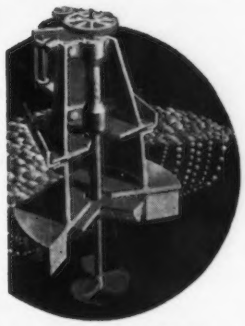

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Argentina *(Continued)*

ince, the Argentine Mining Department (Direccion Nacional de Mineria) has prepared an up-to-date map of Argentina mineral reserves and their location, in an effort to interest foreign capital for their exploitation.

The Department issued a statement in which it declared that Argentina has underground "unsuspected riches of minerals, including uranium."

"For lack of official support, modern machinery, mining experts, and a comprehensive Mining Code," the statement pointed out, "much time has been lost in improvisation and even adventures."

"Petroleum and coal, already in exploitation, are the pillars for the promotion of intensified mining in all parts of the country," the statement went on. "But Argentina offers unlimited amounts of beryllium, copper, lead, zinc, iron and wolfram, among other minerals."

SURINAM

Shipments of bauxite ore from Surinam totaled 2,856,266 metric tons in 1958, with the Surinam Aluminum Co. (Suralco) accounting for 2,340,876 tons and the Dutch producer, Billiton, 524,390 tons. The declining market for bauxite, which began late in 1957, was reflected by a layoff of workers by Suralco in March 1958. The company, after a multilateral bauxite barter agreement with the U.S., began rehiring on a limited scale in August 1958.

IN THE PHILIPPINES

Manila Mining Co. is developing three properties in the Agusan area of Mindanao. A low grade copper section has been explored by tunnelling and diamond drilling. The company's engineers estimate between 4-million and 6-million tons have been developed to date carrying 1.17% copper. Drilling will be continued. A short distance away, other veins with high grade copper were recently found, that should permit direct ore shipments to be made. So far most of the veins average between 5% and 10% copper, across to 2 to 12-ft. widths. On another section of the area, promising gold veins have been uncovered by trenching that offers possibility of a substantial tonnage. Other work is going on at Milagros, on Masbate Island that shows lead, zinc, and copper values. A trucking road is to be built to the property. Chas. A. Mitke is president of the company.

Atlas Consolidated milled 335,600 tons at its Toledo mill in February, averaging 0.68% copper, from which 3,880,000 lb copper and 906 oz gold were obtained, having a gross value of $1,150,000. In addition, the company shipped 13,300 metric tons of iron ore to Japan

WMA (*Continued from page 23*)

put forth a greater effort in the domestic field as the Commission. ". . . the Commission's uranium program, since its inception, has been directed toward the development and utilization of our domestic resources," he said.

Foreign contracting, he said, was undertaken because of the military necessities resulting from breakdown in the United Nations in 1946-47 of the discussions on ban of nuclear armament—and because domestic output was meager at that time.

He said that both domestic and foreign contracting had been carried out on basis of cost of production, or estimated cost of production, including amortization, plus a reasonable profit.

The statement appeared to answer criticism in some quarters of the domestic industry that contracts for foreign purchasing, particularly in regard to South Africa, had not included the "reasonable profit" feature—as have all domestic contract negotiations.

Mr. Johnson warned the miners and millers that the price of uranium concentrates was an important key to the advancement of nuclear energy utilization.

But he said that over a long-range (30 years from now) vantage point, the AEC had been urged by a special research group to:

"Make the fullest use possible of the nuclear energy latent in both uranium and thorium, especially by breeding, recognizing that U_{235} is probably not sufficiently plentiful to contribute significantly to our power needs over the long range."

Mr. Johnson said: "The long range concern is over a possible uranium shortage, not an oversupply."

In the June issue of E&MJ, further coverage of the Wyoming Mining Association meeting will appear, along with photographs of the sessions and the important field trips. Mechanical deadlines prevented the inclusion of the entire report in this issue.—Ed.)

PERSONALS

Sherman Westgard, superintendent of copper refineries of the Great Falls, Mont., reduction department of Anaconda Co., has been appointed superintendent of copper refineries, Raritan Copper Works, International Smelting & Refining Co., Perth Amboy, N. J.

Westgard

Westgard joined Anaconda in 1938 and was employed as a chemist at the Great Falls installation until 1941 when he was named foreman in the electrolytic copper refinery. He became superintendent of copper refineries at Great Falls in 1957.

Leisk

Robinson

Kinsey M. Robinson and **Ross D. Leisk** have been elected to the newly expanded board of directors of the Bunker Hill Co., San Francisco.

Robinson is chairman of the board and president of Washington Water Power Co. and board chairman of the Pacific Northwest Power Co. He is also a director of the National Association of Manufacturers and of the Association of Washington Industries. He is a past director of the Edison Electric Institute and the National Association of Electric Companies.

Leisk is a consulting engineer who has been closely associated with western mining since 1919. He was for many years vice president and a director of United Verde Extension Mining Co., as well as general manager and vice president of Sunshine Mining Co., Kellogg, Idaho. More recently he has been a consultant on several mining operations in Northern Quebec.

Amado Howard Mesta, an engineer with the Comision de Fomento Minera of

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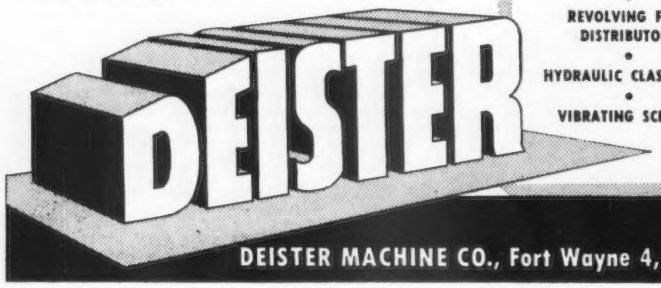

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IN AFRICA

Bancroft Mine in Northern Rhodesia, which shut down in April last year for de-watering operations, re-opened March 31 with a planned output of 50,000 long tons of copper per year.

The high water-table, one of the mine's biggest problems, has been lowered, and 20-million gallons of water are daily pumped from the mine.

The ore reserves at Bancroft, excluding adjacent deposits, are estimated at 50-million tons with an average copper content of 4.76%

The Messina (Transvaal) Development Co. is to develop a third copper mine in Southern Rhodesia, at a cost of $1.4-million. The mine will be situated at Alaska, a small township 70 miles north-west of Salisbury, capital of the Rhodesian Federation.

The first stage of a £12-million ($33.6-million) manganese reduction plant will commence operation in Natal in about three months. Two very large electric furnaces with a capacity of 120 tons of high carbon ferro-manganese daily are due to start operating then. The plant is sited at Cato Ridge, some 30 miles north of Durban. It will be expanded to eight furnaces on the 1,558-acre site and may eventually include a large steelworks.

Interest has been revived in the Volta River hydroelectric project in Ghana, a bauxite-alumina-power scheme which had been studied by the governments of Britain and Ghana and then delayed.

Kaiser Engineers have studied the project, which could cost a total of $900-million with inclusion of power grids for the area around Accra and creation of aluminum smelting plants and a large mining operation. The first stage, according to the New York Times, could be completed for $140-million.

IN INDONESIA

The Bangka Mining Co. (the State owned and operated tin mine on Bangka Island) is contemplating construction of a tin smelter capable of producing 25,000 metric tons of tin metal per year. This is about equal to current production but exceeds Indonesia's portion of the world market. A tin smelter in Indonesia would be of substantial benefit to the local economy as well as foreign credit earnings. Transportation of concentrates from Indonesia to European and American smelters is costly and adds nothing to the national economy. Finished metal available in Indonesia for either export or fabrication would substantially increase returns from the tin operation.

Some preliminary requests for expressions of interest in smelter construction have already been dispatched to various firms throughout the world.

Estimates of costs for the smelter alone start at about $3.5-million. A foreign loan will be sought to help finance construction.

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Personals *(Continued)*

Jack E. McKay, senior lubrication, fuels and instrumentation engineer with Bunker Hill Co., Kellogg, Idaho, since 1955, has been promoted to plant engineer with responsibility for the direction and administration of company-wide maintenance functions. He succeeds **Emmett Waltman,** who has been assigned to work with Dorr-Oliver Inc., Stamford, Conn., on design specifications for the $10-million plant that Bunker Hill plans to build in the northwest next year.

Koepel **Müller**

Norbert F. Koepel, vice president of Anaconda's subsidiaries, Chile Exploration Co. and Andes Copper Mining Co., recently received Chile's Order of Bernardo O'Higgins in the Rank of Knight Commander.

In presenting Koepel with the medal, **Walter Müller,** Chile's new ambassador to the U. S., said that it was "given only to illustrious foreigners who have special affection for and have lent a service of value to Chile." He said the award "is a token of our gratitude for the great work you are doing to benefit Chile and to remind you that Chilean people will always maintain your name in the honor roll of their real friends."

Pickands, Mather & Co. has put through a streamlining program to bring new help to the Duluth office, decentralizing operating responsibility and centralizing administrative functions. The program, which involves many personnel changes, was announced by **E. L. Joppa,** general manager of Pickands, Mather & Co's Lake Superior Mining Div. on Feb. 4. A new planning and industrial engineering division is in the change. Included in the personnel changes brought about by the program are: **T. C. Thielman,** general superintendent of the Hibbing district, has been transferred to Duluth as assistant to the general manager in charge of open pit operations; **Bruce Stuckard,** Hoyt Lakes, general pit foreman for Erie Mining Co., moved to Duluth as administrative assistant to Mr. Thielman; **F. R. Werther,** Ironwood, Mich., general superintendent of the Gogebic range mines, to Duluth as assistant to the general manager in charge of underground operations. His assistant is **W. E. Seppanen,** Caspian, Mich., superintendent of the Iron River district mines. These are all new positions.

C. D. Bailey, Ironwood, has been

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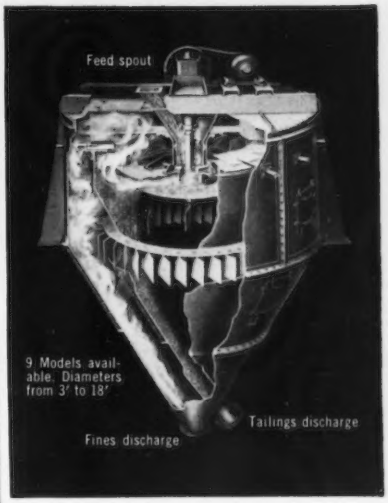

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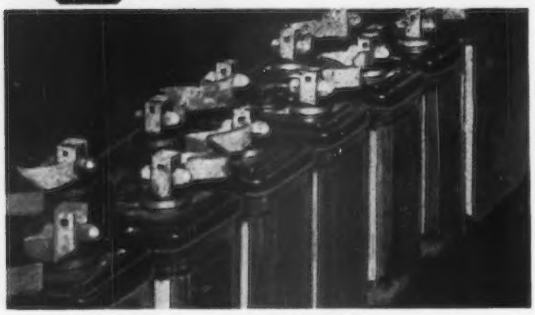

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Personals *(Continued)*

Mexico, a commission for aiding and developing the mining industry, is at the Bunker Hill's Kellog plant this spring to study and learn the company's electrolytic zinc process. When he completes his work, he will report to the International Cooperation Administration at Washington, D.C.

Roman Chelminski has joined Singmaster & Breyer, New York metallurgical and chemical process engineers, as an associate. He had previously been a senior partner of Knowles Associates for twelve years.

Ben E. Richards, superintendent of the Zenith mine at Ely, Pickands, Mather & Co., for 31 years, retired on March 31. He was superintendent at the Utica mine in Hibbing in 1924 after being with the company since 1919, and moved to the Zenith in 1928. He succeeded Kenneth Duncan, retired manager of mines for P.M. & Co. Mr. Richards will continue to make his home in Ely.

Malcolm Condie, former Rock Springs mine union official, has been appointed deputy Wyoming state labor commissioner.

Condie was president of the Wyoming and Utah district of the United Mine Workers and was a member of the Union's international executive board for several years.

James E. Petersen, Ray, Ariz., has been named director of industrial relations, Utah Copper Div., Kennecott Copper Corp., Salt Lake City.

He first joined Kennecott at Bingham mine in 1949 as a trackman, then as a brakeman and dispatcher. In 1952, he was named junior engineer at Ray Div. and held various posts until being named director of industrial relations.

Petersen succeeds **Maurice Strittmatter,** who recently resigned to return to engineering work on the west coast.

Ray Schultze, a former Kellogg, Idaho, mining engineer, was recently named vice president and general manager of the Rio de Oro Uranium Mines, Inc., N.M. He joined the firm in 1957 as manager of the company's Dysart No. 1 mine in the Ambrosia Lake area.

David S. Smith has joined the *E&MJ* staff as assistant editor. He is originally from Denver, Colo. and attended the Colorado School of Mines at Golden. He graduated from Columbia University where he worked at the Lamont Geological Observatory in geochemistry; with the Columbia mineralogy department; and on the Colorado Plateau. Before coming to *E&MJ*, he served two years in the army and one year as assistant traffic manager for an ore exporting firm.

Smith

Personals *(Continued)*

Howard R. McAdams, St. Paul, chief engineer for the mining section of the Minnesota department of taxation for many years, has retired.

Harry Haller, Hibbing, superintendent at Snyder Mining Co.'s Godfrey underground mine near Hibbing has resigned. He has been succeeded by **Oliver A. Axelson,** mining captain, as acting superintendent.

John M. Ohlson, Iron River, Mich., geologist for Inland Steel Co., gave a paper on the geology of the iron formation near Kaministikia, Ontario, near Port Arthur at the fifth annual meeting of the Lake Superior Institute of Geology on April 13. Inland has acquired low grade iron ore in the area.

John Ozzello has been appointed master mechanic at the Sunday Lake mine at Wakefield to succeed **Fritz Gustafson.** Before going to the Sunday Lake, Mr. Ozzello served at the Scranton, Bennett and Albany mines of Pickands, Mather & Co. on the Mesabi range.

OBITUARIES

William H. King, Bureau of Mines supervising engineer at Denver, who died recently, has been honored posthumously with the Dept. of Interior's Meritorious Service Award and Silver Medal.

King, a graduate of the Colorado School of Mines, joined the Bureau at Tucson, Ariz., in 1940. He served there, at Salt Lake City, and Washington, D.C. until 1950 when he was appointed supervisor of contract work on the Leadville, Colo., drainage tunnel.

John H. East, Jr., regional director for the Bureau, said King's unusual initiative and supervisory ability were widely recognized. He was twice executive officer of the DMEA field team which was headquartered in Denver and served seven states, and was twice superintendent of the Bureau's Denver Research Center.

Howard C. Paulsen, 54, Spokane, Wash. a director of Day Mines, Inc., and a son of the original founders of the famous Hercules mine in Idaho, died recently in Hawaii, where he was vacationing. Paulsen has been a director of Day Mines since 1951 and was also a director of the Washington Water Power Co.

Andrew W. Tolonen, 59, mining engineer for Anaconda Co. and a resident of East Butte, Mont., for the past nine years, died April 11 in Pocatello, Idaho. Mr. Tolonen had worked for several mining firms in South America, Alaska, and Canada, and for the USBM. He joined Anaconda nine years ago.

Harold J. Richards, 70, retired former general superintendent for Pickands, Mather & Co. on the Menominee range of Michigan, died March 16 at Coral Gables, Fla. His first mining work was at the Newport mine, Ironwood, in 1910. In 1918 he was made mining captain at the Newport. In 1926 he became superintendent at the Sunday Lake mine at Wakefield and in 1931 he moved to Vulcan as superintendent of the Penn Iron Mining Co. operations. In 1946 he was promoted to general superintendent for Pickands, Mather & Co. with headquarters in Caspian, Mich., holding this position until his retirement.

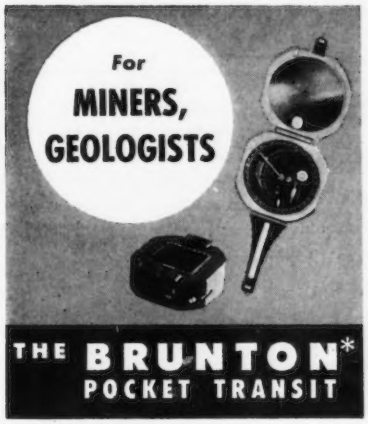
Frank Harry Hayes, former member of the War Production Board, died March 29 at Tucson.

Hayes

Mr. Hayes graduated from Columbia University School of Mines in 1909, and then worked for the Detroit Copper Co., Morenci, Ariz. In 1920 he became assistant to the vice-president and general manager of Phelps-Dodge Corp., Douglas, and in 1922 became superintendent of mines at Copper Queen Branch at Bisbee.

During WW II, he was assistant director of the copper division of the War Production Board and later deputy vice chairman for metals and minerals; and throughout the war served as chairman of the Premium Price Plan for copper, lead, and zinc. After ending his War Production duties, he was appointed chief of the metals and minerals division of the National Production Authority.

Mr. Hayes was a member of AIME, and the American Mining Congress.



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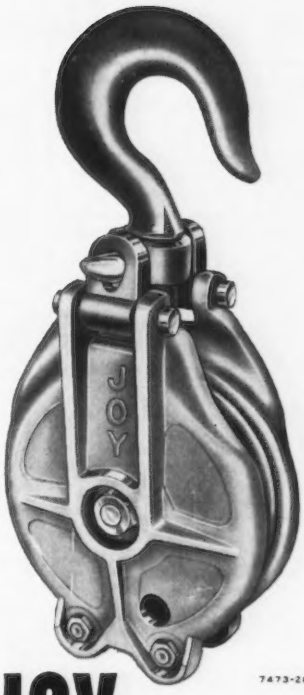

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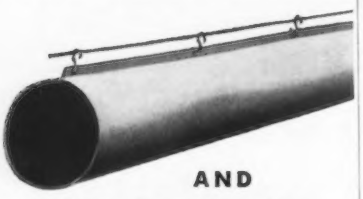

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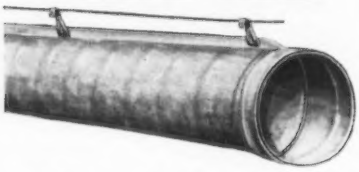

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Personals *(Continued)*

given charge of the company's Menominee and Marquette range mines with headquarters at Caspian, Mich. **A. L. Johnson,** Duluth, operating assistant and formerly underground superintendent of P.M. mines on the Menominee range, was made superintendent of the Mauthe mine at Ironwood, Mich. **L. M. Becker,** Duluth, operating assistant, has moved to Bovey, Minn. as superintendent of the Danube mine. **W. L. Thompte** superintendent at the Danube, has been transferred to the Embarrass mine as superintendent to succeed **G. C. Watts,** who retired on March 1. **R. T. Bell,** Hibbing, assistant general superintendent of the Hibbing district was moved to superintendent of the West Hill and Tioga No. 2 mines in the Grand Rapids area. **J. E. Schleske,** assistant superintendent of the Scranton mine at Hibbing, now assistant superintendent under Mr. Bell. **T. R. Tregembo,** Hibbing, superintendent of the Albany mine, transferred to the Scranton mine as superintendent. **Cecil Scott,** Hibbing, general plant foreman at the Mahoning mine, moved to the Bennet mine at Keewatin as operating assistant to superintendent **E. R. Tyler.** At the Hoyt Lakes plant, Erie Mining Co., **B. F. Borgel** has been appointed assistant work manager, operations; and **J. H. Healy,** assistant works manager, service. **R. E. Peck** has been appointed superintendent of the power plant at Taconite Harbor.

John H. Sharrer, chief engineer for Gogebic range mines, was made an assistant superintendent at the Mauthe mine at Ironwood with **A. J. Cigallo** who is already superintendent there. **Russell L. Jose,** Ironwood, superintendent at the Mauthe, was transferred to the Cary mine at Hurly, Wis., as superintendent **J. C. Wangaard,** Ironwood, continues as superintendent of the Peterson mine at Bessemer.

Paul A. Doorley, executive vice president of Connellsville Mfg. & Mine Supply Co., has been elected president of the Connellsville (Pa.) chamber of commerce for the 1959-60 fiscal year.

Doorley

Doorley is a native of Uniontown and is a graduate of Rider College, Trenton, N. J. He is a past president of the Uniontown Jaycees and was the first president of the Dale Carnegie Club International in Uniontown.

Robert Werner, Minneapolis, has joined the exploration staff of the W. S. Moore Co. in Duluth as a geological engineer.

Daniel O'Brian, mining engineer, formerly at the St. Paul office of the Minnesota Division of Lands & Minerals, has been transferred to the division's office in Hibbing.

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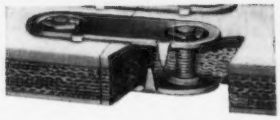

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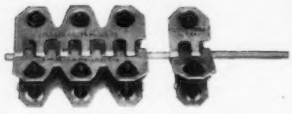

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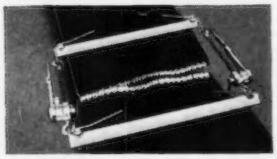

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Flotation Machines
1—1 cell Wemco, 44", 5 HP Motor
1—1 cell Denver, #18 Sp. 32" 3 HP Motor
4—2 cell Gallgher, 48", 15 HP Motor
1—2 cell Denver, #21, 38" x 38"
10—2 cell Fagergren, 56" x 56", 14 S.
1—5 cell Wemco, 44", 5 HP Motors
1—5 cell, Denver #18 Sp. 32", 7½ HP
2—3 cell Fagergren, 56" x 56", 14 S.

Blowers
1—15" LaDel Axial Flow, 1½ HP, 440 V
2—TM 6 Coppus Ventair, 5 HP, 440 V
1—24" Sturtevant Axial Flow, 5 HP, 440 V
6—TM 7 Coppus Ventair, 10 HP, 440 V
8—TM 8 Coppus, Ventair 15 HP, 440 V
1—Series 1000 Joy, 10 HP, 220/440 V, NEW
1—6000 CFM Roots Connersville, RS, 150 HP, 220 V

Hoists, Mine Shaft
2—40 HP Coeur d'Alene Single Drum, Excellent
1—75 HP Puget Sound Single Drum
1—170 HP Allis Chalmers Double Drum
1—600 HP Vulcan Double Drum, 2300 V.
1—500 HP Nordberg Double Drum, 22000# pull, 2300 V.

Jigs
1—6" x 12" Denver Simplex With Drive
3—12" x 18" Denver Duplex, With Drive
1—26" x 26" Bendalari Simplex, Less Motor

500 CFM Gardner-Denver Compressor

Hoists, Slushers & Tuggers
11—15 NN1G Ingersoll Rand 2 drum, 220/440 V.
2—AAF212 Sullivan, 2 Drum, 15 HP, 220/440 V.
1—C-111 Sullivan, 1 drum, 40 HP, 220/440 V.
1—30 MNM 3D Ingersoll Rand, 3 drum, 30 HP, 220/440 V.
2—5 ONM 4D Ingersoll Rand, 2 drum, 50 HP, 220/440 V.
2—CF211 Sullivan, 2 drum, 50 HP, 440 V.
1—50 MNM 4C Ingersoll Rand, 3 drum, 50 HP, 220/440 V.
3—FF211 Joy, 2 drum, air
4—S211 Joy, 2 drum, air
4—A4NNO1, Ingersoll Rand, 2 drum air
4—HKE Gardner Denver, 2 drum, air
1—K4U Ingersoll Rand, 1 drum, air, 3000#
5—HK Gardner Denver, 1 drum, air, 2000#
7—HU, Ingersoll Rand, 1 drum, air, 2000#

Locomotives
17—1½ Ton Mancha Battery, 18-24" ga.
3—1½ Ton Atlas Type J, Battery, 18" ga.
1—2½-3 Ton Jeffrey, 18" ga.
1—3½ Ton Mancha Titan AX, 18" ga.
1—10 Ton Davenport, D-13000 Cat., 36" ga.

Feeders
1—24" x 10' Jeffrey Pan Feeder
1—24" x 5' Denver Adj. Stroke, Belt
1—24" x 8' Denver Adj. Stroke
1—24" x 8' Denver Adj. Stroke, Belt.
1—60" x 28' Jeffrey Pan Feeder, 15 HP

Classifiers
1—36" x 15'-0", Wemco, Model SCM, Spiral
1—45" x 17'-3" Akins Spiral w/drive
1—6' x 22' Dorr Duplex, Rake, w/5 HP
1—7' x 25'-6" Dorr DSFX, Rake Type

Compressors
1—500 CFM Gardner-Denver, HAC, 100 HP, 440 V
1—625 CFM Ingersoll Rand, XCB, 125 HP, 2200 V
1—875 CFM Xre, 175 HP, Syn. 2200 V
1—1000 CFM Chicago Pneumatic, CCB, 200 HP, 440 V
1—1050 CFM G.D., HA, 200 HP, G.E., 2200 V
1—2000 CFM Worthington, 400 HP, 2300 V
1—2500 CFM Sullivan, WN4, 400 HP, West., 2200 V
1—3000 CFM Ingersoll Rand PRE-2, 575 HP, 2200 V

Generators, Diesel
1—75 KW Caterpillar D13,000 220/440 Volt, Diesel
1—100 KW Caterpillar D13,000, 440 Volt, Diesel

Mucking Machines
4—12B Eimco, 24" ga. High or Low Decks
16—GD9 Gardner-Denver, 18"-24" ga.
1—HL3 Sullivan, 18" ga.
5—12B Eimco, 18" ga. Std. Decks

Screens
1—3' x 6' Symons Rod Deck
1—4' x 8' Symons Rod Deck
1—18" x 36" Denver Dillon Single Deck
1—3' x 10' Allis Chalmers Single Deck

Cars, Mine Ore
18—18 cu. ft. C.S. Card, Z18, 18" ga.
41—20 cu. ft. C.S. Card, Z20, 18" ga.
11—30 cu. ft. C.S. Card, Rockerdump, 24" ga.
32—33 cu. ft. Ajax Type, 18" ga.
25—60 cu. ft. C.S. Card, Granby, 30" ga.
32—37½ cu. ft. Ajax Type, 18" ga.
14—84 cu. ft. C.S. Card, Granby, 30" ga.
5—85 cu. ft. C.S. Card, Granby, 30" ga.
8—93 cu. ft. C.S. Card, Granby, 24" ga.
7—100 cu. ft. C.S. Card, Side Dump, 30" ga.
14—130 cu. ft. C.S. Card, Granby, 30" ga.

Filters
1—3' x 3', Denver Pan Simplex w/Vacuum
2—6' — 2 disc Oliver, Complete, 1 HP gearmotor
1—6' — 6 disc Oliver, Complete, 3 HP Motor
1—6' — 5 disc Oliver, Complete, 1½ HP G.E.
1—6'—6' Oliver, All Stainless, Complete

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1—Kennedy 4'x8' rod, 50 HP., end per. disch.
1—Hardinge 6"x36" conical ball mill, 75 HP.
1—Hardinge 4'6"x16" conical ball mill, 25 HP.
4—Allis-Chalmers 5'x22' ball-tube, 150 HP.
1—Allis-Chalmers 6'x16' ball-tube.
1—Marcy 7'x15' rod, 300 HP, 4" liners.
3—Jaw Crushers: 20"x6", 18"x9", 36"x15"
1—Kennedy gyratory crusher, #49-S, 100 HP.

KILNS—DRYERS

1—11'x155' Traylor kiln, ¾" shell, (2) tires.
1—8'x125' Vulcan kiln, ⅞" shell.
1—8'x115' kiln, ½" shell, (2) tires.
1—7'6"x100' Kiln, ½" shell.
4—8'8"x70' Hardinge Dbl. shell dryers, #XA-18.
1—9'x50' Allis-Chalmers dryer, Dbl. shell.
1—6'x50' Louisville rotary dryer.
15—Rotary dryers: 5'6"x50', 4'9"x33', 4'6"x40', 4'x12', 3'x15', 2'x9'.

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2—25 H.P. Gas and Diesel.
1—600 H.P. and one 1000 H.P. General Motors (EMD) Diesel Electric Switchers.

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1—4 ton Westinghouse-Baldwin Locomotive
2—6 ton General Electric Locomotives
2—7 ton General Electric Locomotives
1—7 ton Atlas Locomotive
3—8 ton Ironton Locomotives
2—8 ton Goodman Locomotives
2—8 ton General Electric Locomotives
1—9 ton Whitcomb Locomotive
4—10 ton Atlas Locomotives

JAW CRUSHERS
5—2¼" x 3½" New Morse Lab Crushers
5—4" x 6" New Morse Lab Crushers
1—5" x 6" New Morse Jaw Crusher
1—6½" x 7" Hendy Jaw Crusher
1—8" x 15" Wheeling Jaw Crusher
1—10" x 20" Pacific Jaw Crusher
1—9" x 16" Kue-Ken #30 Balanced Jaw Crusher
1—9" x 36" Cedar Rapids Jaw Crusher
1—20" x 36" Diamond Roller Bearing Jaw Crusher, driven by D-8800 Caterpillar diesel engine

FLOTATION MACHINES
1—29" Fagergren Single Cell
1—36" Fagergren Single Cell
1—38" Morse-Weinig 2 Cell
1—#7 Morse "Jetair" Hydra-cell 22" x 22"
1—4-cell Morse-Weinig, 24" x 24"
1—6-Cell Stearns-Roger 31" Cells
1—6-Cell Fagergren 36" Cells
1—2-cell Fagergren, 66"
1—6-cell Denver #21, 38" x 44"
1—4-cell Denver #21, 38" x 44"

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1—4' x 4' Hersch Ball Mill
1—4' x 4' Marcy Ball Mill
1—6' x 4' Hardinge Conical Ball Mill
1—64½" Marcy Ball Mill
1—8' x 22' Hardinge Conical Ball Mill
1—3' x 7' Morse New Rod Mill
1—5' x 10' Allis Chalmers Rod Mill
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1—20-HP H&B
1—25-HP Vulcan #1½
1—30-HP Vulcan #22C
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1—50-HP H&B
1—50-HP W. A. Box
1—75-HP Vulcan
1—100-HP W. A. Box
1—112-HP Vulcan
1—150-HP Vulcan
1—150-HP Ottumwa
1—250-HP Ottumwa

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1—75-HP H&B Complete with Steel Headframe
1—75-100 HP, Clutched Drums, Post Brakes
1—82-HP Vulcan #5½
1—100-HP Webster, Clamp & Lane
1—150-HP Jackson

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1—Joy Model FF211
1—Joy Model S-211

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8—Ingersoll-Rand Model EUA
2—Ingersoll-Rand Model 10HR
8—Gardner-Denver Model HK
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2—Ingersoll-Rand Model 10H
1—Sullivan Model HA3
4—Ingersoll-Rand Model 1H
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1—Sullivan Model L-111

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2—7½-HP Sullivan, Single Drum, Model HE
4—5-HP Sullivan, Double-Drum, Model HDE
1—15-HP Ingersoll-Rand Model 15NN-1G
2—20-HP Ingersoll-Rand Model 20NM2C

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2—Eimco 12B, 18" ga.
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1—1'8" Traylor Type TY Gyratory
1—2' Symons Standard Cone Crusher

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2—16" x 10" McFarlane Crushing Rolls
1—40" x 20" Cedar Rapids Crushing Rolls

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1—6' x 3' Dorrco Internal Drum
1—6' x 8' Morse

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2—6' 2 disc Oliver
1—6' 4 disc Oliver
1—6' 5 disc Morse

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1—24" Shriver filter press
2—4' x 10' Kelly Filter Presses, Acid Proof.
1—Sweetland #12 Pressure Filter Press.

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1—2" Galigher Vacseal pump
1—2" Denver vertical sand pump
1—2" Wemco rubber lined sand pump
1—3" A.S.H. Hydroseal rubber lined pump
1—3" Wemco sand pump
2—4" A.S.H. Hydroseal rubber lined pumps
2—4" Wilfley sand pumps

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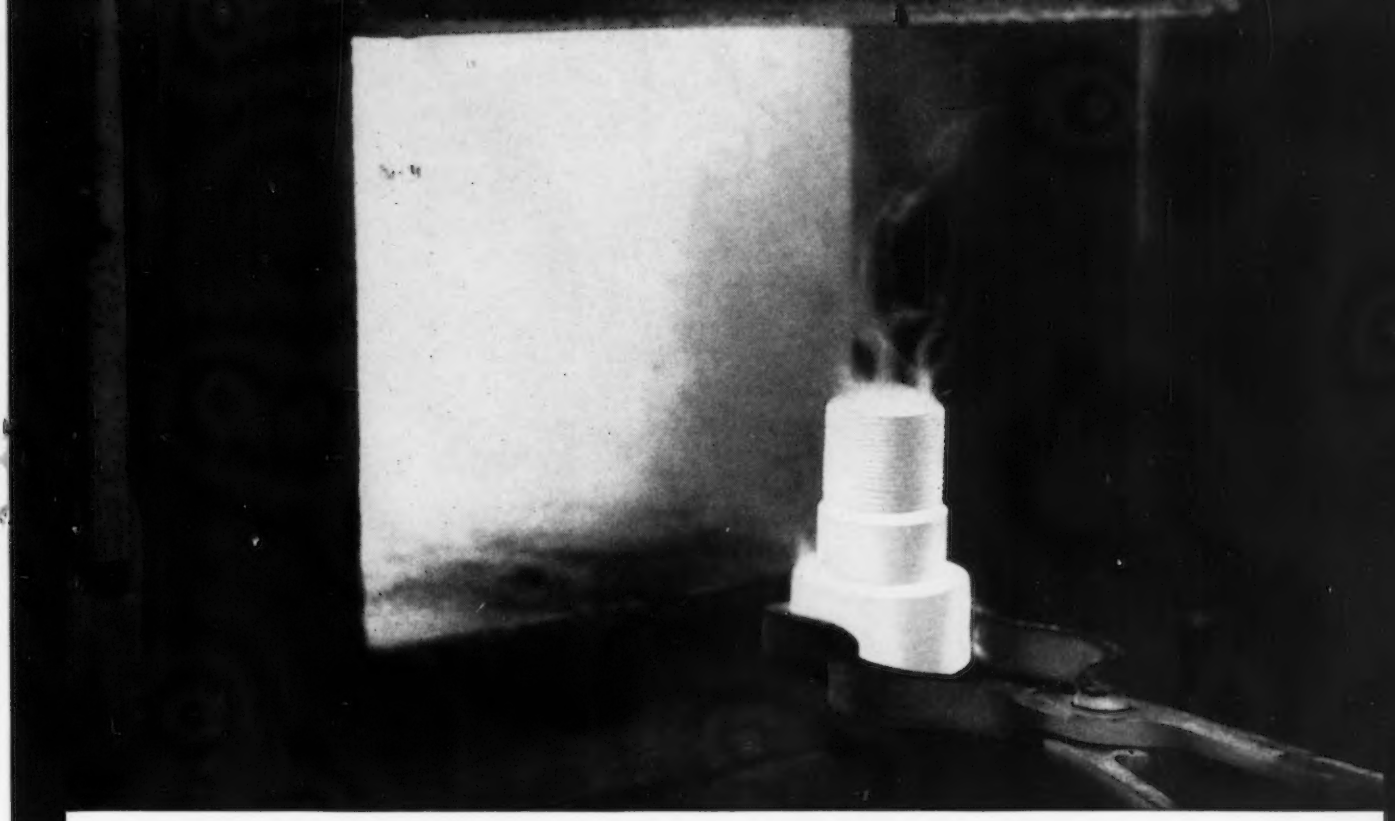

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ADVERTISING SALES STAFF

Atlanta 3 ..... M. H. Miller, 1301 Rhodes-Haverty Bldg., Jackson 3-6951
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Los Angeles 17 .. J. B. Uphoff, 1125 W. 6th St., Huntley 2-5450
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Philadelphia 3 ..... J. B. Lewis, 6 Penn Center Plaza, Locust 8-4330
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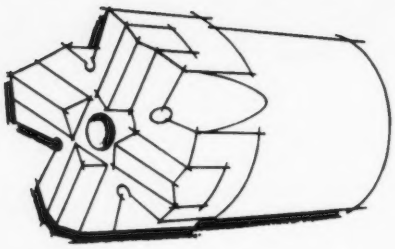
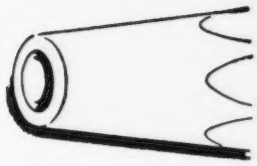
San Francisco 4 ..... J. W. Otterson, 68 Post St., Douglas 2-4600
EUROPE ..... Michael R. Zeynel 85, Westendstrasse, Frankfurt/Main, Germany
McGraw-Hill House, E. E. Schirmer, 95 Farringdon St., London, E.C. 4



Removable



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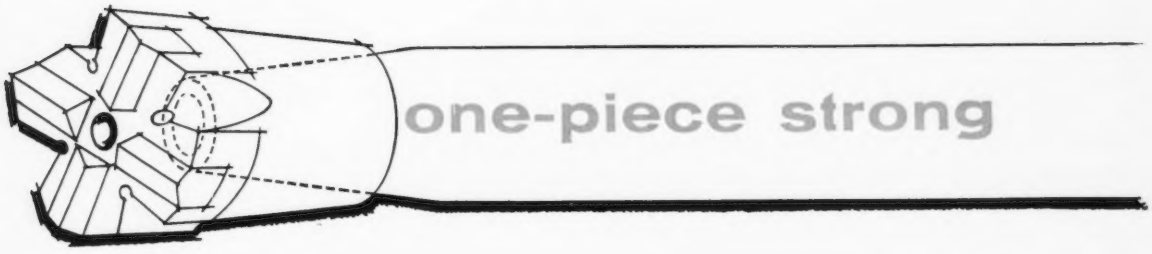
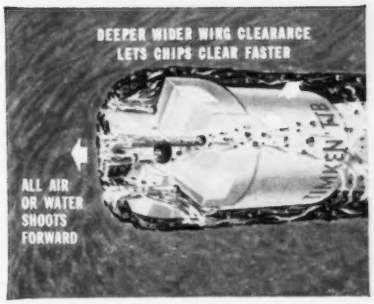


That's why the new Timken® air-leg bit cuts your drilling costs these 4 ways

1. You don't have to throw away good drill steels when the carbides wear out, the way you do with intrasets. The new Timken bit is removable!
2. You don't have to haul an armful of steel to the mine the way you do with intrasets. A pocketful of Timken removable bits is enough for a whole day's work.
3. You can change bit gauge sizes fast on the same steel with new Timken bit for air-legs. Using intrasets you have to change the whole steel.
4. You carry only the bit to the shop for resharpening—when it's a Timken removable bit. With intrasets you "fight" the whole steel and Timken bits give longer gauge wear because there are *four* carbide cutting edges. Most intrasets have only two.

Get all these savings in an air-leg bit that's *tapered* for one-piece strength. And get faster chip clearance, too (see diagram at right).

Specify the new Timken tapered socket carbide insert bit for air-leg drills. For free brochure write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. ***Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.***



CHIPS CLEAR FASTER because 1) five front holes shoot water or air directly against the rock face and 2) deeper, wider wing clearance lets chips wash back faster.

TIMKEN® AVAILABLE NOW!
THE AIR-LEG BIT OF THE FUTURE!